A Merry Christmas and A Happy New Year

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VOL. CIII., No. 26. NEW YORK, DECEMBER 27, 1915. WHOLE No. 2,136.

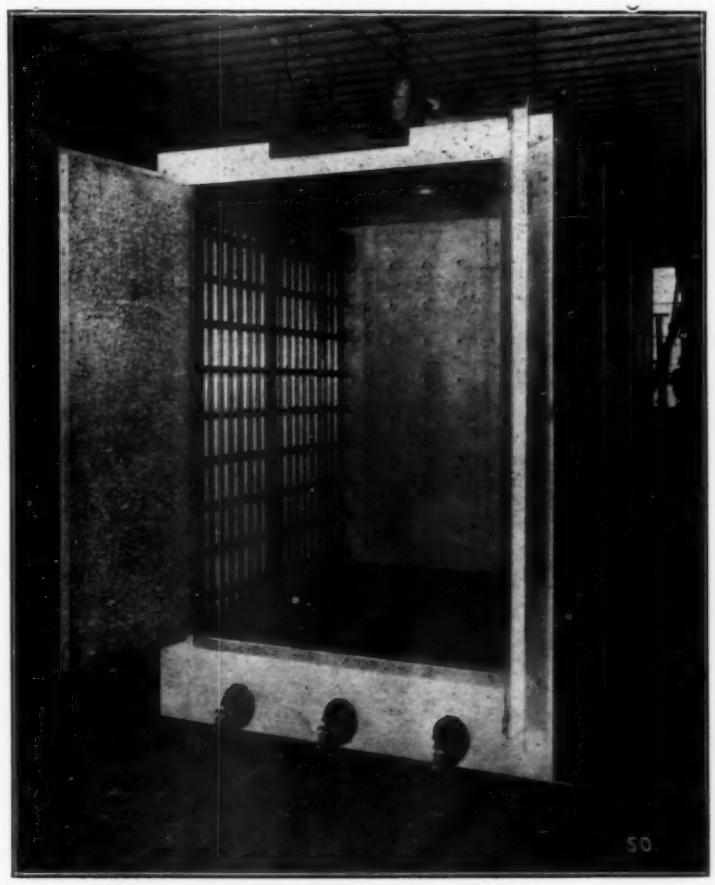
GAS vs. ELECTRICITY FOR JAPANNING AND ENAMELING OVENS.

By C. L. GEHNRICH of the Gehnrich Indirect Heat Oven Company.

Every industrial gas man should read the article on "Electrically Heated Japanning Ovens," by Messrs. Hirshfeld and Dygert in the October 23 issue of the "Electrical World." It is a warning to the gas industry at large. The business which the gas companies now enjoy from this type of equipment is to be taken away, to a large degree, unless the gas interests awaken to the fact that they have a competitor who is making a strong play and will succeed if the gas companies do not give more consideration to selling the proper and better type of Japanning oven. The electric interests admit there is a large field, and they are going after it. In fact they have spent thousands of dollars in the past 5 years experimenting; going so far as to make several extensive installations without cost to the users. Why are they doing this? Because they know that there is profitable business in sights shown by the fact that no method of finishing metal has shown greater increase in the past few years than Japanning and Enameling.

The increasing demand for better finishes, by the automobile industries and metal furniture manufacturers, made necessary a change in oven construction, to take the place of the common direct gas-heated type. We foresaw these conditions several years ago, and developed the Radiator Type Oven, which is strictly Indirect Gas Heated. The introduction of this type of oven has revolutionized the process of baking japan and enamel. How, I will prove to you later.

Japanning and enameling have developed into a scientific process, from the crude methods employed by the Japanese. We read that they were the originators of the art, and that they dried the japan by the heat of the sun. There are no records to show how long this method continued; so I will only go back to 1880, the year in which my company built their first oven. Since then we have seen many changes—from our first wood-fire oven to our present indirect gas-heated oven. Our first step from the wood-fire oven was the coal oven, then steam, and last, gas. The results with the latter were far superior to the others, with the exception, perhaps, of steam in some cases. The results were by no means perfect, and the ovens were not producing. By this I mean they were not efficient. The work was not clean; uniform results were not possible, and costs were high. It is true that there are thousands of direct gas-heated ovens in use, and that the users claim they are getting results. As far as they know they are, because they have not looked beyond the fact that they were baking. The life of the finish, the production, the costs, and the baking period are never considered.



Gehnrich Radiator Type Oven.

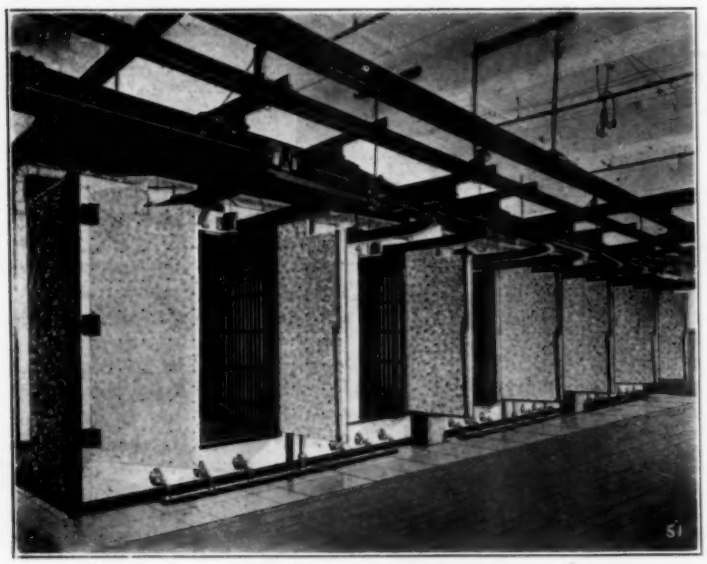
Eighteen years ago we attempted to introduce an indirect gas heated japanning oven of a different type than the one we now build. The time was not ripe for development, and we therefore continued with our direct heated ovens; but in those days we built as many steam ovens as gas. To-day conditions are different. The manufacturers of automobiles, metal furniture and interior trim call for better finishes, efficiency, production and economy. Tests made of the finishes baked by steam and direct gas heat showed, that while the work had the appearance of being finished it proved to be in appearance only. This was not satisfactory. They wanted more than that. They wanted a finish that would withstand weather conditions; they wanted increased output per unit, and efficiency. At this point experiments were made with superheated steam, and electricity, and while both gave better quality they were most unsatisfactory on account of production costs. Superheated steam was dangerous, and electricity was a luxury as it still remains to-day, and its up to the gas man to keep it there. We, however, saw what was coming, and hence the development of the Radiator Type Oven, which is a strictly indirected gas-heated oven, and fresh preheated air baking system. Its introduction a few years ago changed the method of japanning and enameling. The gas consumption in these ovens is providing profitable returns to many companies, which, without doubt, would otherwise be going to the electric interests. This new oven has been approved by the Board of Fire Underwriters, and by chemists and manufacturers of japan and enamel.

Why was it not possible to do the same with direct gas-heated ovens?

The answer is brought out in the article by Messrs. Hirshfeld and Dygert, and it is the only talking point advanced by the electrical

advocates. They claim that the products of combustion effect the finish and is noticeable when comparing black japan baked in the gas oven with that baked in the electrically heated oven. Colored enamels, because of the pigments in them, discolor on account of the reaction between the pigments and the products of combustion. This is true of a direct gas heated oven, and I agree with them completely. Baking japan and enamels is an oxidizing process, requiring fresh air; in order to produce satisfactory results, oxygen is necessary. In the direct heated oven the oxygen is consumed by the gas, and the products of combustion, largely water vapor, fill the oven. It is impossible to get perfect results, as these products bathe the work, and cause soft, spongy and dull finishes, and retard the baking. Better results are possible when using direct heat, by increasing the baking time and baking at higher temperatures; but this increases the cost, and still the results are not good, or even uniform.

The electrical advocates claim that they have reduced the baking period about 50%, which is possible with the quality of heat furnished. For indirect heat, I claim we have made many installations where we have reduced baking time better than 50%. For example, we installed a battery of ovens at the H. H. Franklin Mfg. Co., Syracuse, N. Y., taking out direct gas-heated ovens to make room for the new battery. At this plant we reduced the baking period more than 50%, and the results were perfect. Absolutely no rubbing due to baking is necessary, the little rubbing done now being due to gritty enamel. The class of work done at this plant calls for the highest possible finishes, and covers such articles as mud guards, fenders, etc., for high grade automobiles. In an article in the October 7th issue of the "Iron Age," Mr. G. Babcock, Production Manager of this plant, refers to the installation as follows: "Japanning plays an important part in protective coating on an automobile. After dipping in the japan, the parts are hooked on trolleys, shown in the illustration, suspended by brackets from the ceiling, and allowed to drip for a few minutes. They are then run into the drying ovens and baked at temperatures shown in the table. The Indirect Gehnrich Ovens, shown in this illustration, do not allow the burnt gases to act upon the japans. All the products of combustion are carried up the sides of the ovens in the tubes as shown. There are no draughts needed in the ovens to maintain burning gas, and, therefore, none of the dust of room is carried into the oven and deposited on the work."



Radiator Ovens at Plant of H. H. Franklin Mfg. Co.

I have shown that better finishes are possible with indirect gas heat, which not only means holding the gas business for this type of equipment, but the opportunities for increasing it could not be better. I will now give an example of the costs of operating one of the largest ovens in use, as compared with electricity, taking the figures given by Hirshfeld and Eygert as the basis, which I believe they submitted as an average.

The oven referred to was installed at the works of the Seng Co., Chicago, Ills. The oven is 50 feet long, 8 feet 6" high inside, and divided into two compartments, each 6 feet wide. The product is spring beds, such as are used in davenports and pullmantes. An overhead trolly system is used for loading and unloading the oven. The following is the average daily run:

Working data of the Gehnrich Oven, July 27, 1915.

Working temperature: Maximum, 425° F.; minimum, 320° F.

Bake No	Time In.	N. Time Out	Totol Time. Hrs. Min.	Weight. Lbs.
1	7:	8:15	1 15	6,384
2	8:20	9:05	45	4,370
3	9:15	10:05	50	7,139
4	10:15	10:50	35	5,565
5	11:	11:40	40	5,828
6	11:45	12:20	35	5,565
7	12:35	1:10	35	6,330
8	1:15	1:55	40	7,518
9	2:05	2:45	40	7,798
10	2:50	3:30	40	7,101
11	3:35	7 A.M	Soak	6,819

Total weight baked	70,417 pounds
Gas consumption	23,600 cu. ft.
Oven lighted	10 hours
Total number of bakes	11
Average time per bake	54 minutes
" weight per bake	6,402 pounds
" gas per bake	2,145 feet
Cost of gas per bake	$1.716

NOTE.—As the oven was lighted at 6 A.M. and the first bake put in at 7 A.M. the actual average time per bake is 43 minutes. The cost for gas is $1.37; and average weight of 3¼ tons gives 42 cents per ton cost.

Accepting the figures given by Hirshfeld and Dygert, that it requires one kw. hr. for every 10 pounds of material, it would cost $2 per ton to do the same work we are turning out for 42c. per ton, figuring costs at 80 cts. per 1,000 cubic feet for gas and electricity at 1 cent per kwh. I do not know on what temperature they have based their figures, but I feel safe in saying that it is not over 425° F. It must be remembered that the consumption of gas depends upon the temperature, the nature of the material and the methods used for loading and unloading. The material treated above is light compared with the amount of room it occupies in the oven. Heavy cast iron products will show even better results.

Radiator Oven—Seng Company.

The electricals interest claim indirect heat reduces thermal efficiency. What if it does? The quality of the heat increases production by reducing the baking period. The most delicate shades, even white enamel, are successfully baked by indirect heat. One of the largest metal furniture manufacturers installed Indirect Heated Ovens to take the place of steam, and we are at present building a large equipment for another noted metal furniture concern to take the place of direct heated ovens.

Comparing the Radiator Type Oven with direct heated gas oven, it costs less to operate by indirect heat than the direct heated type because of the increased production per unit and better finish.

What have the electrical advocates to offer that has any advantage over indirect heat, such as our Radiator Type Oven? They

cannot turn out better quality of work, they cannot come near the costs of operation, and they admit that explosions and fires are possible because of the ever present hazard of short circuits, arcs and sparks. There is only one hazard connected with an indirect gas heated oven, and that is an explosion caused by a fool operator. It would require a fool to cause such results as turning on the gas and forgetting to light it until he has found a match. Such chances are very remote, and they are more than offset by the hazards connected with the electric oven. Even should a careless operator turn on the gas and forget to light it until some time has elapsed, the effect of the explosion would be minimized by the fact that the combustion chamber is directly connected with a flue to carry off the escaping gas. This flue is open at all times, and the baking compartment cannot become filled with gas.

Nothing has been said as to maintenance cost of the electric oven. This is a matter to be considered, as the heating elements sometimes burn out at a very short intervals, depending on the conditions under which the oven is operated. The atmospheric gas burners used in our ovens are practically indistructible.

In the matter of control and range of temperature, gas has the advantage over electric. Intermediate temperatures are possible with gas without any special controlling devices. Electric ovens can be made to operate at any temperature required in japanning and enameling ovens, but it means an elaborate and costly equipment.

Indirect Gas-Heated Ovens cost more to build than the direct heated type, but this cost is not to be considered. It is a first cost only, not a continuous high operating expense such as with the electrically heated oven.

As to the specifications covering construction suggested by Messrs. Hershfeld and Dygert, I must simply ignore this, since our thirty-five years as oven builders has taught us exactly the kind of construction, the most practicable, and the most servicable for obtaining the highest efficiency and economy.

In conclusion, I say to the Industrial Gas Man—Wake up, and don't let the electric interests get your business; and remember this slogan. "The Indirect Way Is The Right Way."

Just as we were going to press, we have word of the explosion of a large electrically heated japaning oven at the plant of the Reo Motor Car Company, Lansing, Mich. The oven, a brick and steel structure, was blown to pieces so that not a brick was left standing. Mr. Gehnrich mentions this hazard of electrically heated ovens.

THE FUNDAMENTAL PRINCIPLES OF GOOD LIGHTING.

By P. G. NUTTING, Eastman Kodak Company, to the N. C. G. A., at Washington.

Illuminating engineering is one of the very youngest of the professions. It has in fact been recognized as a profession only during the last decade, and it is at present by no means full fledged. Quite likely another ten years will elapse before the basic principles now being worked out will have become familiar practice. There are three well defined stages in the development of any profession. First, there is a long period of pure empiricism, partly traditional and partly spontaneous, of rough and ready methods applied more or less at haphazard. The second stage is one of scientific inquiry and the establishment of fundamental principles; while the third and final period of growth is characterized by the working out of the practical applications of these basic principles. Illuminating engineering appears to be just approaching the final stage, and it is here proposed to outline the chief scientific principles upon which the theory of good lighting is based. The title chosen is far too ambitious, but indicates the nature of our discussion.

There are three chief classes of principles upon which the character of lighting depends: (1) Those relating to the sources of the light: (2) those relating to reflecting and scattering properties of objects within the field of view receiving the light; and (3) the properties of the eye itself. What the eye sees depends as much upon the eye itself as upon what is to be seen. What is to be seen is largely within our control, but the seeing ability of our eyes is quite without our power to control. Hence it is, that obtaining proper lighting is largely a question of photometric study, specification and design. The question of what is proper lighting, on the contrary, can only be answered by careful study of the properties of the eye. The scientific foundation of illuminating engineering consists, therefore, of two main branches: the photometry of sources of light and of diffusing media, and a formulation of the complex visual properties of the human eye. Each of these branches is both quite old and very new; old in that much has been known of them since much has been known of any branch of science; new in that only within the last two decades have they received careful attention by modern scientific methods.

Simple candle power photometry dates back several generations. There have always been a multiplicity of photometers, but precision photometry and the establisment of fixed units and of standards of precisely known value, date back hardly to the beginning of this century. It is only very recently that satisfactory illumination and brightness photometers have been available. Scattered light photometry has been of the very crudest until within the last few years, and even the methods used in analyzing mixtures of diffuse and specular light and in specifying the properties of materials which scatter light, have been open to serious objections. A committee of the Illuminating Engineering Society, after considerable investigation, has this year drawn up reports dealing with precise practical methods of determining the properties of such diffusing media as paper, lamp globes, interior furnishings and projection screens.

The industrial side of the development of lighting has made excellent progress. It is both a cause and an effect of the development of the fundamental principles of lighting. In broad terms, practically any desired form of lighting unit or any form of diffusing medium within reason, may now be had. It is largely due to the lowered cost of light, through increased efficiency of illuminants, that we have any lighting problem at all, for it is when an abundance of light is available that questions concerning the best possible lighting arise.

Of the fundamental principles concerned in lighting, the question of cost of light may be passed, since it is simply one of reduction; questions of the choice and placing of illuminants, and of reflecting and diffusing media, must be referred back to the properties of the eye to determine what is desirable. *The eye furnishes the sole means of judging whether lighting is good or bad*, and only by a careful study of the eye shall we be able to say what lighting is best and what are safe limits of tolerance under any given fixed conditions. The properties of the eye, upon which the principles of lighting depend, are the reactions of the retina to radiation of any given quality and quantity. Regarded as a physical instrument the eye is very similar to a photographic camera, consisting essentially of a lens and a sensitive surface. Curiously enough, the reactions of the retina and of the photographic plate to light were first carefully investigated at about the same time, 20 years ago, the latter by Hurter and Driffield in England, and the retina by Arthur König and various collaborators. König recognized and attacked the problems involved with great acumen and success. Within the past ten years much of his work has been repeated with suitable modern apparatus, and extended in various directions; at the same time the data obtained have been reduced to useful form and applied to many practical problems.

The principles of good lighting involve directly but a few of the physical properties of the eye, namely, those related to visual efficiency and tolerance. Criteria of good lighting rest ultimately with the performance of the eye itself; that is, upon the ease, comfort and precision with which the eye functions. The eye accommodates itself to some changes in lighting conditions with extreme facility, to others with great difficulty or not at all. The greatly increased use of artificial light, cinematography and other conditions have burdened the eye in many new ways, conditions for which it has not been prepared by evolution. The statement, however, may be ventured that when certain rules of lighting are obeyed the eye will be *less* subject to strain than ever before.

For hundreds of generations human eyes have been fitted to operate efficiently by natural light, and we have every reason to believe that eyes were originally developed to work best under natural conditions of illumination. For three-fourths of his waking hours man was accustomed to a daylight characterized by a high level of brightness, moderate brightness contrasts and considerable color contrasts. The remaining quarter of his active ex-

istence was spent with a very much lower illumination, and at this level, vision was merely sufficient for finding his way about. The eye has never developed more than the crudest discrimination for color or color differences, nor for brightness contrasts at the lower level of natural illumination. Since man has lived in caves, huts and houses, his eyes have been subjected not only to extremes in brightness, but to excessive contrasts as well. Light coming largely from a single direction, throws dense shadows, and these, together with the source of light itself, cause contrasts far in excess of those ordinarily met with in the open. Whether or not the eye has changed to meet these increased requirements we have no means of knowing. Very likely it has, judging by its adaptability and its present state of adaptation for operating under extreme contrasts.

In recent times a large part of the civilized peoples spends a considerable proportion of its time within doors, and nearly half of that with artificial illumination. Both daylight and artificial lighting conditions are largely in the hands of the architect and illuminating engineer, and with abundant illumination available we may well inquire carefully into the lighting conditions leading to a maximum of eye comfort and efficiency.

Brightness of Field of View.—In respect to the absolute brightness of the field of view, the eye not only tolerates a very wide range indeed—a range of at least one hundred million to one—but operates with precision over a range really enormous compared with that of any instrument constructed by man.

Provided the surroundings are of the same order of brightness, a newspaper may be read with fair comfort by the average person when it is illuminated by full sunlight, which is about the maximum brightness tolerable to an eye exposed continuously to it and with no very much darker areas within the field of view. For convenient reference, it may be stated that this brightness is about 10 lamberts, or roughly 20 candle power per square inch. The minimum of brightness required for comfortable reading, again assuming a normal eye and no excessive contrasts, is about 1/100,000 of this value, or numerically, 0.1 millilambert. One object may be distinguished from another when its brightness is but a ten-thousandth of the latter figure. The eye operates over as wide a range as would a pair of scales that could weigh anything from a ton of hay to a marble with equally high precision, and would swing perceptibly to the weight of a fly's leg. The eye accomplishes this wonderful feat by automatically varying its sensibility to correspond with the brightness of the field viewed. Through the middle range of brightnesses, the sensibility decreases to about 1/20 its value for an increase of 100 times in brightness of field.

When the brightness is changed abruptly, as when an electric light is switched on or off, the sensibility does require time to adapt itself. Roughly the sensibility is doubled or haved in about one second, it varies by a factor of ten in about five seconds and a factor of one hundred in ten minutes.

These apparently trivial and well-known facts reach the very foundations of the principles of good lighting, and it will be necessary to give them more detailed attention. I shall not burden you with tables of data and formulas, on the one hand, nor with mere physiological speculation on the other. What immediately concerns the illuminating engineer, and the producer of gas or electricity, is how much illumination is best under various working conditions, in houses and factories and on streets, where lighting units should be placed, and the distribution of light that is most favorable. The answers of all these and similar questions are contained in the properties of the eye, such as are outlined above, and cannot be obtained elsewhere.

Brightness Levels.—The relation of the eye to lighting problems is perhaps best set forth by considering but a few of the lighting levels of most importance, rather than a whole series of levels. We have to deal largely with retinal sensibility because the brightness of objects seen varies with the sensibility, and lighting is rated in terms of apparent brightness. A headlight that dazzles at night, is barely noticeable at noonday; it is not the actual brightness of the headlight that is of consequence, but the brightness sensation produced by it.

The lighting conditions under which most of our time is spent fall chiefly into four distinct groups: (1) Bright daylight in the open; (2) interiors in the daylight; (3) interiors under artificial illumination, and (4) out of doors at night. A great many measurements have been made of the brightness of objects commonly within the field of view in each of these four cases. Rough averages give the corresponding brightness levels as listed in the table below.

A rough average of the brightness of objects out of doors in full sunlight, is about 1 lambert, or 1,000 millilamberts (m. l.), the brightness of the clear sky at midday being roughly 1 lambert.[1] Similarly, a rough average of the brightness in an average interior with bright daylight outside, is 10 m.l., one hundredth as bright as objects out of doors. A comfortable brightness in interiors at night is 0.1 m.l., and of objects out of doors at night, 0.001 m.l., each brightness level being 1% of the next higher. In an average room, reading or writing on a very dull overcast day, we turn on the lights when the mean brightness of the field of view is about one millilambert.

In the second column are the just perceptible differences in brightness expressed as fractions of the whole. In the third column are the brightnesses just perceptible with the eye accommodated for some time to the brightness level of the first column. The last three colums show the relative sensibility of the retina at the four chief adaptation levels. Three kinds of sensibility are represented, sensibility to brightness glare, to contrast, and threshold sensibility. Relative sensibility to glare is roughly inversely proportional to the brightness of objects just painfully bright when the eye is adapted to the brightness level indicated in the first column.

Other things being equal, these data supply a fund of useful information to the illuminating engineer, relating to best lighting levels, glare and threshold limits, etc. But other things are not equal, contrasts vary enormously in offices, factories, public halls, and living rooms. Lighting costs must also be considered. Different kinds of work require varying degrees of attention; for drafting, color matching and proof reading, requiring the closest observation, the nicest possible adjustment of illumination will be found to pay. But for ordinary work, presenting but moderate contrasts and requiring but moderate visual attention, there is little to choose between a general brightness level of 100 millilamberts and one of 0.1 m.l., a thousand times less. For work requiring close attention, probably *the best mean brightness is about 10 m.l.*, if the whole field of view is of fairly uniform brightness; 100 m.l. if bright highlights and deep shadows are visible.

Rate of Adaptation.—The rate of retinal adaptation from one sensibility to another is an important factor in a few lighting problems. A flickering light is intensely disagreeable, and is not tolerated in ordinary lighting. A periodic flicker of a frequency of over about 40 per second is not noticeable. In lighting by alternating current arcs or a Moore tube, the frequency of flicker is usually 60 cycles, and it is not apparent to the eye, does not depress visual acuity nor produce eye fatigue. In motion picture projections the flicker, with a good machine, having a three-blade shutter, is just beyond the perceptible limit, the discomfort observed in seats near the screen being probably entirely muscular, due to displacement, not intensity flicker.

Nor is a single quick flash very harmful to vision, provided its duration is extremely short. The total energy received at any one point of the retina is very small, even in viewing a lightning flash, and it is energy rather than intensity that determines the impression in such a case. A longer flash, however, such as may be obtained from an electric switch, or the flash of a headlight, is the most injurious of all, for the total amount of light emitted is considerable and the damage is done before the eye can adapt itself to the high intensity.

1. The lambert is the unit of brightness recently adopted by the Illuminating Engineering Society. It is the brightness of a perfectly diffusing surface radiating or reflecting one lumen per square centimeter. Brightness expressed in candles per square inch may be reduced to lamberts by multiplying by 0.4868.

Brightness is preferably expressed in lamberts, not only because of the brevity of the name, but because of the apparent ambiguity of other terms in many cases. It is difficult, for example, to think of the brightness of the sky in candles per square inch.

		Mean Brightness Level.		Difference Sensibility.	Threshold.		Relative Sensibility Glare.	Contrast.	Threshold.
1.	Exterior daylight	1000.	m. l.	0.0175	0.35	m. l.	1	1	1
2.	Interiors in daylight	10.	m. l.	0.030	0.017	m. l.	200	60	20
3.	Interiors at night	0.1	m. l.	0.123	0.0014	m. l.	18000	1400	350
4.	Exteriors at night	0.001	m. l.	0.79	0.00011	m. l.	160000	22000	3100

When the eye is subject to a bright light for a short time, as in passing an automobile headlight, the sensibility falls very rapidly at first, then more slowly. If again exposed to darkness the sensibility recovers in a similar manner and at about half the rate. We have some data for a brightness of 25 m.l., a brightness quite blinding to an eye adapted to darkness, but yet only one thousandth as bright as the average auto headlight:

Time 1 second,	sensibility increase,	2.1	times,	decrease	1.6	times
" 2 seconds,	"	"	4.2	"	"	2.6	"
" 5 "	"	"	16.2	"	"	7.6	"
" 10 "	"	"	58.	"	"	14.4	"
" 10 minutes,	"	"	120.	"	"	20.9	"

If suddenly exposed to such a light, the eye in 5 seconds drops to 1/16 its sensibility, and after 10 seconds subsequent exposure to darkness has by no means recovered its sensitive state.

We see largely by contrasts in brightness; we see best when contrasts are over 10:9 and less than 20:1. When the eye is adapted to darkness, as it is out of doors at night, objects exhibiting but faint contrasts do not become visible as rapidly as those with greater contrasts.

In the following table are the brightnesses of background against which a darker strip is just visible after 0, 5, 10 and 30 seconds:

Contrast.	1:0	10:1	2:1	10:9
Instantaneous....	.0010	.0013	.0044	.021
5 seconds.....	.00013	.00014	.00053	.0053
10 seconds.....	.000053	.00010	.00042	.0042
30 seconds.....	.0000021	.000028	.00018	.0030

These show the rate at which contrasts shown at the top of each column become visible. With a contrast of but 100:97 (just perceptible) the sensibility did not increase at all after the first few seconds.

In passing rapidly along a street the eye is subjected to large fluctuations in brightness at quite regular intervals, and this causes a very considerable depression in sensibility, for the reason just stated. The sensibility adapts itself to the brighter places more rapidly than it recovers in the darker, the net result being that the retina is less sensitive than if exposed to a steady average brightness. Street lighting is vastly more efficient when more evenly distributed. It would be much less efficient were there not such a lag of sensibility behind the sensation.

Similarly, in viewing any contrasty field with the attention constantly wandering from light to dark and from dark to light objects, the rate of adaptation is involved. The general effect is to lower sensibility, and the result is that much more illumination is required to attain visual comfort and acuity than in a field of but moderate contrasts. The subject will be considered further in the discussion of excessive contrasts.

The Effect of Contrast.—The degree of contrast within the field of view has a very considerable influence upon the sensibility of the retina and, therefore, upon the level of illumination that is desirable in any given case. Under natural illumination in the open, contrasts exceeding 20:1 in ratio of brightnesses are rarely met with, while in interiors they are common. Excessive contrasts are annoying, probably because the eye has not yet been developed to operate comfortably when excessive contrasts are present.

Contrasts are due, almost entirely, to two causes; differences in reflecting power, and depth of shadows. The reflecting powers of ink and paper are in about the ratio of 1:20. Out of doors, shadows are not as a rule very deep, because even on a clear day from 15 to 30% as much light comes from the sky as from the sun, and the shadows are illuminated by sky light. In interiors, when the light is not well diffused, very dense shadows are the rule because largely unlighted. Further, glossy furniture, paper and other objects reflect sources of light specularly, giving glare spots often many times as bright as their surroundings.

Some recent work on this subject, reported at the I. E. S. Convention, indicates that both the shadows and the glare spots tend to depress retinal sensibility below that corresponding to the general level of brightness. A large white card in front of the observer contained a window of opal glass which could be illuminated from behind, After gazing steadily at the white card illuminated to a fixed known brightness for some time, the light was switched off and a brightness of opal window found that was just visable. This instantaneous threshold was found to increase very considerably as the area of white card viewed was more and more constricted. When this was further constricted by viewing through a black lined tube with but a small hole at the distant end, the opal window had to be made twenty to forty times as bright to be just visible as when the eye was accommodated to the whole field of view. That is to say, darkening all the field except that directly viewed, not only did not increase the sensibility of the retina (apparent brightness of spot) as might have been expected, but actually *decreased* it by a large factor. And these results were obtained with but moderate working brightnesses; in fact the effect is less with excessively bright fields.

This depression of sensibility when the area viewed is considerably brighter than its surroundings is of extreme importance, because it is not only large, but occurs very commonly in practice. Whenever we view a printed page this condition obtains. The obvious remedy is a light distribution to give *lighter surrounding objects free from large and deep shadows.*

A bright glare spot within the field of view, but at one side of the object of our attention, is also of very common occurrence. Such a spot has two distinct effects on vision, discomfort and a depression of sensibility. The ocular discomfort caused by a lamp flame or filament within the field of view is, so far as we know, largely a matter of intrinsic brilliancy of source, and is relieved by a diffusing shade.

The depression of sensibility, on the contrary, is not relieved by a diffusing shade. We have plenty of data to show that the depression of sensibility caused by a source of given candle power is *not* lessened by spreading the source and keeping the total candle power constant. If the brightness is kept constant and the area (i, e., total candle power) varied, then the depression varies as the square root of the candle power or area. If both area and candle power are kept constant, and the angle from the axis of vision varied, the depression is about half as great at 25° as at the axis, and is almost negligible at angles above 40° from the axis.

Practical Applications.—In practice, then, contrasty fields of view are to be avoided; when unavoidable they should be illuminated to a much higher mean level of brightness than fields presenting but moderate contrasts. For example, in offices and living rooms conditions may be so arranged that only contrasts of twenty to one, or less, are presented to the eye. This means only indirect or semi-indirect illumination, white ceilings, light colored walls, an absence of very dark furniture and no glossy surfaces anywhere. Under such conditions the eye operates with comfort and precision, with an average brightness of objects as low as 0.1 m.l. and a brightness of paper or other object worked upon of but 1 millilambert.

On the other hand, consider the opposite extreme, in which contrasts are excessive and cannot be greatly reduced; as in machine shops, foundries and rolling mills. Bright metal parts abound, most surfaces have but a very low diffuse reflecting power. The work given closest attention is a mass of contrasty detail. Indirect illumination and white ceiling or walls are impracticable. Under such con ditions the eye operates at low efficiency, and the best that can be done is to provide abundant illumination. Fully ten times the mean brightness and 100 times as great an illumination are required, as in rooms containing moderate contrasts. It goes without saying that excessive contrasts, particularly those due to glossy surfaces, are to be avoided; much less light is required, and eye work is far less fatigning.

The question of glossy surfaces on print paper and on furniture has been given considerable attention. Printers prefer glossy paper and ink for the reproduction of pictures. Mat papers are available that will take half tone printing, but they are expensive and tend to foul the plates. By one process good reproductions may be made even on newspaper stock, but the process is expensive. Why not, then, print on glossy paper and depend upon diffuse illumination to avoid spot glare? The reason is apparent to any one who will view a glossy print under the very diffuse light of the open sky. The diffuse skylight specularly reflected from the glossy surface, produces a gray veil over the whole picture, more or less concealing the details of the print. We prefer to view a glossy print under directed light, inclining it at such an angle that no glare spot is seen, rather than have a gray veil over the whole which cannot be got rid of.

Much the same reasoning applies to glossy furniture. Mat furniture finishes are not common, and are objected to on the ground that they are more difficult to clean, and tend to conceal the fine detail of the wood grain. However, with glossy furniture, the veiling glare with indirect illumination is worse than the spot glare with direct illumination, so that the choice of finishes will be a matter of preference until satisfactory mat finishes are available. The chief advantage of indirect over direct illumination is not that it avoids spot glare, but that it eliminates the eye discomfort due to a bright source in the field of view. In other words, while direct illumination on glossy surfaces gives spot glare, which is

bad, indirect illumination gives veiling glare, which is quite as distasteful to most persons. Glare spots should be eliminated by avoiding glossy surfaces, rather than by diffusing the illumination.

In one typical case direct illumination is much preferred if not essential, and from it valuable general conclusions may be drawn. Needle work is much more difficult and trying to the eyes under very diffuse than under directed illumination. Needles and fibers are a mass of fine bright cylinders, and depth discrimination is important. Under directed lighting, needles and fibers are imaged largely as fine bright lines with interspersed shadows as a background. Under highly diffused lighting, bright lines and shadows tend to merge, and seeing conditions are bad.

The degree of attention given the object viewed is an important factor in retinal adaptation and, therefore, one which must be reckoned with. On entering a dark room we "get our eyes" far more quickly when we try to distinguish objects or details, than if we merely close the eyes. Ths difference is readily measurable. In our experiments on the rate of dark adaptation, the time is noted after which a test object with a given faint illumination first becomes visible. If a keen effort be made to see the test object it becomes visible considerably sooner than if we close the eyes and wait. A similar effect may be noted in adaptation from a lower to a higher brightness.

The inference relating to good lighting is obvious and has been long recognized. Where work requires close attention, such as proof reading, drafting and certain textile work, great consideration must be given to securing proper lighting to minimize the strain due to close attention. Where there is the least gloss, to avoid veiling glare the lighting should not be too diffuse, and should be so directed that there is no spot glare into the eyes. Both extremes of diffusion are common in drafting rooms, the happy medium being rarely found.

Lighting Practice.—In order to obtain a more concrete view of the lighting principles just discussed, let us consider more particulary the problems of (1) interior daylight lighting, (2) interior lighting by artificial light, and (3) street lighting.

In any *interior lighting* the bulk of the light should come from above the eye level. The brightest objects within the field of view should not be over 100 times as bright as the darkest objects or shadows. Within 30° of the eye level, the mean level of brightness should not be above 100 millilamberts nor below 1 m.l., and no contrasts should exceed 20 : 1 or 1.3 units in the subjective brightness scale.

Such ideal conditions are, of course, very rarely found. During the daytime the bulk of the light enters through windows, largely at eye level. If a window is within the field of view, we see, perhaps, a patch of sky a full lambert in brightness, and adjacent to it a strip of casing or wall not well lighted, frequently of low reflecting power and not over a millilambert in brightness. The bright light from the sky goes largely to the floor instead of the ceiling, a ceiling frequently finished in materials of low reflecting power and sometimes even in wood with a dark finish. Such dismal quarters are tolerated only because so common. The best practice appears to be to have snow white ceilings, walls of a fairly light tint and floors or floor coverings not darker than new oak or pine. The window problem is a difficult one. Ribbed glass panes and white shades are worse than useless, for they become themselves powerful sources of light at eye level. An inclined opaque shade, extending into the room at the level of the middle of the window, mat white below and coated with metal paint above, keeps the directed skylight from the eyes and throws it on the ceiling, where it is best to have it.

The artificial lighting of interiors is less difficult to put on a reasonably correct basis. A suitable shade may be used to reduce the brightness of any lighting unit to within the limit of comfort (about 250 millilamberts) and throw the bulk of the light on a white ceiling. A suitable number of units properly placed will prevent dense shadows. The best tints for ceilings, walls and floors are such as are also suitable for daylight lighting. Glossy and dark colored furniture and fixtures are to be avoided, particularly near the center of a room.

Good *street lighting* presents many serious difficulties. It is much more important to secure greater uniformity of lighting than to increase the total light. At the present time amply lighted streets are common; streets with properly distributed illumination very rare. Much light escapes in the upper hemisphere which might easily be thrown downward. Much light is thrown laterally toward residences where it is neither desired nor appreciated; a judicious use of reflectors would throw this light to the street and sidewalk where it would be of service. Fortunately, dazzling lights are becoming less common, and increasing attention is being given the distribution of light.

All things considered, but little progress has been made in the application of the principles of correct lighting. This fact is surprising in view of the simplicity of the principles, and the comparative ease with which lighting may be modified. It is gratifying that there has been little if any opposition to such improvements on the ground of probable disturbance in the demand for gas and electric supply. Lack of progress is rather to be attributed to ignorance and indifference, in the face of other more urgent problems involving far greater financial outlays.

Summary.—The eye is our sole means of judging whether illumination is satisfactory or defective. The desirable properties of light sources, and of the field illuminated, depend upon the properties of the eye that is to view the field.

Lighting such as to produce a mean brightness level higher than 1 lambert is excessive under all conditions; a brightness level under 0.1 millilambert is too low for any purpose requiring discernment of detail.

With but moderate contrasts (20:1 or less) within the field of view, and work requiring no greater attention than reading, there is but little to choose between a mean field brightness of 1 and 100 millilamberts. For work requiring close attention, such as drafting or needle work, the most desirable brightness is about 10 millilamberts.

The greater the contrasts with the field or view, the higher (10 to 50 times) the mean level of brighthess instinctively demanded by the eye.

There are four levels of brightness of chief interest to the illuminating engineer; exteriors in daylight (mean level 1,000 millilamberts), interiors in daylight (10 m.l.), interiors under artificial ilumination (0.1 m.l.) and out of doors as night, 0.001 m.l. The instantaneous threshold and the retinal sensibility (threshold, contrast and glare) are given for each level.

For interiors, no illuminant within the field of view should be brighter than 250 millilamberts, and no contrast should exceed 100:1.

Glossy furniture, dark furniture and dark shadows are to be avoided, on account of the excessive contrasts they are liable to introduce.

The distribution of brightness in an interior is preferably in the proportion of 100 at the ceiling, to 30 or 40 at the eye level, and 10 to 20 below eye level.

Rapid alterations in brightness are not to be tolerated, unless more rapid than 40 per second.

Quick changes in brightness over wide ranges are to be avoided. These may produce mere discomfort, temporary injury or permanent injury to the eye.

Our discussion has been an attempt to elucidate the principles of efficient lighting, efficient in the double sense of making the best possible use of the light, and in enabling the eye to operate under the most favorable conditions. Extremists have, on the one hand, tolerated any lighting that did not cause permanent injury to the eyes; and on the other have raised trivial objections to even minor causes of discomfort. I have no sympathy with either view; what should be done, in my opinion, and what is worth our best consideration and effort, is the relief of our over worked and much abused eyes from the wear and tear of the bad lighting conditions that we have ourselves put upon them. It would be unwise and unneccessary to relieve them of all discomfort at all times, that would surely result in a deterioration of the adaptability of the eye. Our standard should be the comfort of out-of-doors daylight lighting; abundant light well diffused and—by far the most important—but moderate contrasts anywhere. Under but tolerable lighting conditions, the eye is wonderfully adaptable and efficient, and it is to be hoped that within the near future it will be relieved of the many trying conditions under which it is now called upon to operate.

A Man's Duty.

No workmen's compensation act can compensate an honest, thrifty workman and his family—no accident insurance can compensate an employer, for the burden in the home of a disabled worker, or the presence in the shop or on the street of a new hand substituted for one trained and efficient.

Emergencies may arise when self must be forgotten in the effort to save life or property, but such emergencies may be made well nigh impossible by employers and employees adapting and living up to the slogan, "Be Careful First."—S. T. Bodine.

What Every Gas Company Should Give.

Illustration from "Concerning Municipal Ownership."

Cooking with Gas on a Mammoth Scale.

By E. M. PATERSON.

Over 10,000 soldiers quartered in Toronto have their meals prepared in kitchens equipped with Gas Ranges and Gas Water Heaters.

The Military Authorities having in mind, as always, the comfort of the soldiers under their jurisdiction, have equipped the various kitchens at the Exhibition Park and the old General Hospital with "Up-to-date" gas ranges.

This step was not taken until after exhaustive tests had been completed, and the various merits and demerits of coal and gas as fuel for cooking thoroughly investigated. Gas won out, much to the delight of the Sergeant Cooks and their assistants, who have to look after the all important problem of preparing and cooking the soldiers' meals.

What this means to those who are so engaged, only those who have tried cooking on the coal range, and cooking with gas, can imagine. No muss, no dirt, no waiting for the stubborn fire to burn up, kitchens not over-heated, no ashes to sift, no dirt flying around, just a clean wholesome kitchen, with the heat quite under control, and all this without waste of time and without loss of temper. The food is properly cooked, not only on the side, but cooked through, with all the nutritious juices retained.

Many of us know what a comfort the gas range is in our own home, but it is hard to realize the immense benefits derived from its use where the troops are concerned. Needless to say, they appreciate the use of gas in the preparation of their meals.

Of course it was necessary to study the matter of cost. Economy plays quite a large part in military circles, just as it does in any other organized public service or private business.

In order to prove that the original tests were quite correct, the gas meters have been read daily since the various units took up their winter quarters; and the readings show the gas consumed is costing less than one-half of one cent per day per man.

Just try to realize what this means. Three good meals cooked for a healthy man, who has obtained a good appetite through strenuous exercise in the open air, for the modicum of less than one-half of one cent, and cooked with the smallest amount of trouble, and the least amount of labor, and with the elimination of all dirt. This surely is efficiency with economy.

Now a word regarding the equipment chosen for this mammoth task. In order that each unit should be placed on an equal footing, it was absolutely necessary that the authorities should standardize the cooking equipment. After comparing costs and efficiency, a range was selected, comprising two ovens, with four star top burners over each oven, making eight top burners in all. It was estimated that eight of these double ranges would be sufficient to cook for a Battalion, comprising approximately 1,200 men. This estimate has proven to be correct, and this number of ranges has been allotted to each Battalion, the smaller units being equipped in proportion. Altogether, at this time, there are 101 double ranges in use at the two camps, and these will be added, to from time to time, as other units are organized and quartered. Gas is also used to heat the water, both for kitchen purposes and for tub and shower baths. A large instantaneous automatic water heater is installed in the Railway Building, supplying sufficient hot water for six showers. The hospital, situated in the Women's Building, is also equipped with an automatic water heater, supplying four tub baths. For kitchen purposes, the tanks are connected with water heaters of the coil type, similar to those used in the majority of Toronto homes.

In order to supply the various buildings with gas (almost every building is in use, including the stables and sheep pens) it was necessary to lay a new main at the east end of the Fair Grounds, nearly 1,500 feet in length, in itself no small undertaking—besides extending several of the services.

So gas will play a very important part in the camp life this winter in Toronto, the same as it does in most homes in the city, and the tendency will be to make the kitchen and mess room more homelike, the cooking better and more nourishing; besides lessening the labor of all interested.

A Natural Trouble.

The newspapers are full of items like the following, showing the troubles of those depending on natural gas:

Last night the gas shortage resulted in considerable discomfort. The gas company had looked forward to increasing materially its supply through a well completed yesterday on the S. P. Williams farm in the town of Sheridan, but it proved a dry hole. Fearing that the shortage of gas will continue and may become even more pronounced, numerous residents of Dunkirk are buying coal.

Reports received from Westfield and Mayville are to the effect that there is a gas shortage there also. A report was in circulation to-day that legal proceedings will soon be instituted in an effort to conserve the South Shore Company's gas supply for Dunkirk.

Telephone - John, 2996.

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NEW YORK, MONDAY, DECEMBER 27, 1915.

Joint Tar Distilling Plants.

English gas men are seriously considering the project of organizing two or three joint tar treating plants, to handle the tar from neighboring gas works. They seem to think that the tar distilling concerns do not give them fair treatment, and that a co-operative plant to dehydrate, and perhaps distil tar, would be profitable for the smaller undertakings.

In Germany, most of the smaller works are members of the Verland Deutscher Gas Fabriken, which has plants for treating tar and ammonia at several central points, and handle all the residuals of the member-companies.

A similar scheme here, or some other way to make a market for the small producer of tar, should be able to find a place in the industry.

Comparing Gas and Electric Ovens.

Numerous designs of ovens for japanning and and enameling, using direct heat from gas or from electricity are operated with varying degrees of success; but the advantages of indirect heating in these lines of work are being recognized. Some months ago, a report on Electrically Heated Japanning Ovens was made to one of the electrical associations, which appeared to be a comparison of a poor gas installation with a good electric one; and as an answer to the rather damaging statements, we publish a reply that we believe will give a clearer understanding of the underlying principles, and will assist the gas man to hold this important load, as well obtain more of it.

While the article is written by a manufacturer of appliances, it shows such a real knowledge of the processes, that it cannot be said to be unduly biased.

Utilities Won't Be So Fortunate.

In an effort to increase the income of the city of New York, assessments on personal property of individuals and business houses were raised a hundred million dollars or more. But ninety-nine per cent. of these increases were taken off by the process of swearing that they were unreasonable.

Now the State Board of Tax Commissioners has been marking up the valuation of special franchises in the larger cities, the total for New York city being made $480,248,750, a net increase of $62,482,400. If this increase is maintained, it will mean that the city of New York will receive for 1916, $1,331,000 more revenue from that source than in 1915.

About $6,000,000 has been added to the valuation of Buffalo special franchises.

Some of the big additions made to New York city franchises are: Brooklyn Union Gas system, $16,383,600, and Consolidated Gas system, $23,961,600.

Protests have been filed for the Brooklyn Rapid Transit Company, the New York Railway Company, the Manhattan Elevated Railroad Company, the Brooklyn Union Gas Company, the Brooklyn Edison Company, and the Consolidated Gas Company.

The Commission, President Saxe says, will examine the officers of these corporations.

We fear they will not receive as generous treatment as the aforesaid individual kickers.

An Enlarged Public Ownership Scheme.

The California Legislature has passed, and the Governor approved, a Public Utility District Act, under which districts comprising two or more municipalities, or unincorporated territories, may be formed for acquiring or building works for the supply of water, light, power, heat, transportation and communication. Action has already been started looking to a union of Oakley, Berkeley and Alameda, to acquire an adequate water supply, and a district was recently formed in Marin county to acquire the properties of an existing water company.

The scheme is an enlargement of municipal ownership of public utilities, with all the objectionable features of political organization and control.

The act requires that at least 15% of the electors in each municipality sign a petition calling an election on the formation of the utility district; and if passed by a majority vote the legislature shall declare the district formed.

A board of directors numbering as many as there are individual units, with three or four additional members to make an odd number on the board, has to be elected within three months, and each director holds office for four years and receives not to exceed three thousand six hundred dollars a year. The board has much the same powers as a private corporation and in addition can exercise the right of eminent domain.

It can take the initiative in acquiring or constructing a utility, or this may be done through a petition signed by fifteen per cent. of the electors.

The cost of the utility may be paid out of the revenues of the district or by incurring bonded indebtedness. The act provides that only revenue-producing utilities shall be acquired, owned or operated, it being the intention that all charges and expenditures and the interest and principal on the bonded debt be paid from revenue derived from the district's utilities.

If the utility don't pay they can, of course, raise the price of service, and there is no provision for an examination as to the efficiency of operation and management.

Is Your Company An Asset?

The Shreveport, La., "Journal" printed this article showing the influence the public service companies may have upon a city's activities:

"What makes a live town? It is largely relative. What sort of a town suits you?"

To the religiously inclined man, a town in which an atmosphere of evangelism is constantly being stirred, would be just about right. To the sportively inclined, a so-called wide-open town, with saloons and a quiet little game going on in the back room, and a police force not too Puritanical, would be a live one. The aesthetic would regard box trees and flowered boulevards, glazed brick fronts, art galleries and sympphony concerts as about the correct thing. But the hard-headed business man, the one who has to make a living, not only for himself but for most of the people, has other ideas about it, in which none of the above have first place. To him a live town is a place to work; where convenience is the pronounced feature; where waste of time and energy are eliminated. This means properly co-ordinated public utilities.

Here is a case in point. Not many years ago, a Shreveport man

went out to San Diego, California, to go into business, and spent a few days looking over the field before unpacking his trunks.

The first thing he noted was the general apathy of the inhabitants. They came down about 9 o'clock in the morning, opened their places of business, sat down and read the paper, smoked a cigarette, gossiped idly, went out for a drink about 11 o'clock, and knocked off for lunch a little later. They got back about 2 o'clock, and the afternoon was a repetition of the morning. It was a land of dolce far niente. This did not suit our Shreveporter, and he moved on.

Recently he revisited San Diego, and was astonished at the vim of the people and the progressiveness of the town. Everything went with a snap. The street cars, which formerly were dirty as well as small, had wobbled along on uneven tracks; now they were large and clean, and moved swiftly on heavy rails. The streets were cleaner, the hotels were better, the people moved with more spirit, and were better mannered and better dressed. This change that had come over the town was magical.

"What have you done to San Diego?" he asked a friend. "When I was here before, it was a dead one; now it is full of ginger."

"You'll laugh at me when I tell you," replied the friend. It's our public utility companies that have caused the change."

"I don't get you," said the man from Shreveport "What have they to do with it?"

"It's like this. A few years ago all our public utilities were at their lowest ebb. The alleys were impassable with garbage and ashes, and the streets were knee deep in dust and old paper. And then——"

"Yes, and then?" said the Shreveporter, eagerly.

"Then we got a new deal. The public utilities companies woke up to their duty. At any rate, they saw where they were losing money all around by their service. The men at the top got the efficiency bug. They realized their opportunities. They took the folks into their confidence and laid their hands on the table. They said, in effect, 'Here, people, we've been going at this thing all wrong; we're going to change the system, and we want you to help us. We'll give a square deal, good service all around, but we want your patronage at a fair price.'"

"Fine!" exclaimed the Shreveporter. "And then what?" "Well, we got a new street car system, with the necessary extensions, good service and lots of transfers. Then we got better water and a rebuilt sewer system. The old gas company quit, and we got a lot of new men and modern methods in its place. The results were instantaneous. The people began to spruce up. They put some real men into the city hall, and the streets were cleaned and the hose turned into the alleys. Buildings began to go up all over. The suburbs began to build under the stimulus of the street car line extensions. The whole town and every one in it began to liven up."

"Got a dose of the ozone of efficiency, so to speak," ventured the Shreveporter.

"Now you've said it. That was just it. The public utilities companies came to life and they carried the whole town up with them. Out here we have come to the conclusion that a town is no better than its public works of all kinds."

City planning and public utilities are in the same box. City planning a few years ago was a fascinating thing to read about; to-day it is stern necessity with all the picturesqueness taken out of it. Formerly its advocates talked of making the city a sort of extended country estate. Now the city planners want co-ordination with the public utilities companies in order that the city may first be made a proper place to work and live in. Beauty will follow.

The citizen must be able to move about his city swiftly and comfortably. He must be supplied with the purest water. Garbage, ashes, sewage must be disposed of with the least trouble to the city, the least offense to the residents, and, if possible, at a profit to the municipality. It must be lighted well and cheaply, and its telephonic communication must be as nearly perfect as modern science can make it. The new city planning deals with cities already existent; it creates no new cities. Therefore the daily life of a city is in the hands of the companies that furnish the public utilities or necessities; and to make the city live truly well their service must be as nearly perfect as possible. The people who pay for these things ought to have them. If they haven't them no one is to blame except themselves. The public utilities companies will give them.

But what about parks and boulevards? How are we to get them? We have no companies to furnish them.

Have no fear. Once the standard of living has become as high as it can be and should be, the people will get the parks and boulevards of their own volition. City planning contemplates them also.

When all this shall have happened, Shreveport will be the livest in the Southland, the city of heart's desire."

There's Room for Both.

It should not be necessary to resort to the bugaboo of electric interruptions, in order to sell gas lighting services; but when a combination plant goes so far in their efforts to give gas a black eye that they only have a few out-of-date brackets in the Show Room, and do not keep these in good order, it serves that Company right when the electric current does not function and their office and sales rooms are left in semi-darkness. This particular gas company—the above is based upon an actual occurrence, not fancy—is owned by a large electric organization which in its endeavors to further the electric side is losing opportunities for its stockholders by not having buildings piped throughout so that gas may be used for fuel, if they do not want it used for light. We can wish no greater hardship to the powers that are responsible for this short-sighted policy than to have them entertain their friends in a house heated with electric radiators some cold day when the furnace is out.

Institute Directors' Meeting.

The December meeting of the Board of Directors of the American Gas Institute was held at the office of the Institute Thursday, December 9th, with the following present:

Wm. E. McKay, president; Geo. G. Ramsdell, secretary; D. D. Barnum, C. O. Bond, R. B. Brown, R. W. Bush, C. H. Butcher, G. B. Cortelyou, B. F. Cresson, A. H. Elliott, J. B. Klumpp, C. H. Nettleton and W. R. Addicks, past president.

The committee on next place of meeting submitted a report unanimously recommending Chicago, which upon motion, was adopted. The meeting will be held October 18, 19 and 20, 1916.

The matter of enlarged quarters, which has been under consideration for several weeks, was disposed of by taking four rooms on the seventh floor of the United Engineering Societies Building, rooms No. 707, 709, 710 and 711; room 707 will be used as a store room, 709 as a Directors' and Committee room, and 710 and 711 as offices. The work in recent years has grown so much that larger space was necessary; in addition to which it was important to have the rooms so arranged that one of them could be used exclusively, if desired, for meetings of Directors, Committees, etc., and for the accommodation of members visiting the city.

Membership of the Institute in the National Fire Protection Association was renewed for the coming year.

Mr. Geo. S. Barrows was appointed to represent the Institute in connection with the American Society of Heating and Ventilating Engineers, when such representation is necessary or desirable.

BRITISH PRACTICE IN THE CONDENSATION, WASHING AND SCRUBBING OF COAL GAS.

Paper by DR. W. B. DAVIDSON, to the International Gas Congress.

It cannot be said that general British practice in the condensation of coal gas is based on accepted scientific principles. It must be remembered, however, that most installations of condensing plant in this country were put into use probably more than 30 years ago, and have been found to answer their purpose sufficiently well and, being constructed principally of cast iron, are still in so good condition that their renewal is hardly warranted.

It is only in recent years that the subject of condensation has received special attention, the naphthalene bogey having caused general concern. Modern opinion is divided regarding the respective merits of slow and rapid cooling of the crude gas, and new condensing plant is designed to carry out the one or the other according to the idea prevailing in the mind of the engineer. Practically all the older designs actually in use are built for slow condensation.

Feld's remarkable process of fractional condensation—a method of slow and elaborate cooling combined with washing—tried in Germany 7 years ago and later in Belgium on coke oven works, has apparently met with small success. No one in this country has been bold enough to give it a trial on a working scale. The Klönne cooling tower is said to have met with great success in Germany. This consists of a large steel cylindrical vessel in which the travel of the gas is very much slowed down and condensate drips down against the stream, cooling progressing slowly. This design has, so far as the writer is aware, not been imitated in this country.

TAKE-OFF PIPES.

It is the first stage of condensation of the crude hot gas that is found to cause the greatest trouble and loss. It is questionable if any system of carbonizing is quite immune from "stopped pipes."

Ascension or "take-off" pipes vary in diameter from 6 to 8″. Inclined retorts are generally fitted with one 8″ pipe at the bottom end; horizontal through retorts have one pipe of 8″, or two of 6″. There is an objection to increasing the size of the pipe in that greater labor is required in augering.

Water drips are sometimes fitted to the middle of the H pipe, the drip inside the pipe preventing the baking of the pitch deposited on the sides. Unless the amount of water is carefully regulated, inconvenience is experienced by the tar running down to the mouth-piece and the weaking of the ammoniacal liquor.

Relief has been afforded in many instances by the adoption of a system of heavier charges of coal with a corresponding increase in the period of distillation, thus 6-hour charging has been abandoned in favor of 8, 10 or 12-hour work.

The take-off pipes (usually 8″ diameter) of continuous vertical retorts do not give much trouble. The same cannot be said for the pipes (6″) of intermittent verticals, however.

HYDRAULIC MAINS.

Large differences in practice are to be seen in the method of utilizing the hydraulic mains. It is the general custom to maintain a liquor seal by allowing a constant supply of weak ammoniacal liquor to run in by open jets and overflow by a Weir valve, one of which usually serves several beds. A large amount of cooling is thus effected, the greater part of the tar and a small portion of the virgin liquor being deposited. In some works tar seal and tar circulation are in use. Here naturally the hydraulic main is hotter and less condensation takes place, but the loss of ammonia from open jets of liquor is saved.

In comparatively few places is it customary to work without a seal, but this practice is growing, particularly with vertical retorts. With coke ovens the practice is already general. The great advantage from this arrangement is the maintenance of a more uniform pressure in the retort than is possible when the depth of the seal of the dip pipes varies, as it is bound to do more or less under old conditions, there being thus much less risk of loss of gas through back pressure, on the one hand, or dilution of the gas with nitrogen and carbon dioxide, on the other. In any case where "overpulling" is indulged in, the pipes and hydraulic main become overheated and tar is converted into pitch or even coke.

With old fashioned retorts the formation of pitch in the hydraulic main or foul main is of unusual occurrance. With modern vertical retorts or coke ovens, which require no long ascention pipes, pitch formation has to be carefully provided for, either by rapid tar circulation or raking of the mains, as with coke ovens and intermittent vertical retorts, or by raking and fishing out the lumps of pitch with continuous vertical retorts. In these cases the prevention or removal of pitch is a task of no little difficulty and one that appreciably affects the working cost.

Ammonia chloride, when not dissolved by liquor in the hydraulic main, has been found rather troublesome, especially with intermittent vertical retort installations. When the gas is very hot this salt is carried along, at first in the form of vapor, and afterwards as fine crystals, until the temperature is lowered to about 220° F.

The salt has a tendency to build up at bends of the main, or on the valve and connections of the retort governor. It carries down tar with it in about equal quantity. Spraying of the affected spot with weak ammoniacal liquor has proved an effective remedy for this trouble.

CONDENSERS.

Many old established gas works have air condensers only, and no auxiliary water condenser. The older types of battery, horizontal and vertical air condensers, are being superseded by the vertical annular design, which, by means of butterfly valves at the base, permit the internal cooling draught of air to be regulated. It is customary to make provision for water sprays to aid air cooling in hot weather.

Formerly, when the gas was distilled from the retorts at lower temperature than now-a-days, much less naphthalene was produced than now, and moreover a greater proportion of the vapors of light oils went to make up the composition of purified gas, the result being that naphthalene blockages were practically unknown. It is now not uncommon to find air condensers setting up heavy back pressure, owing to naphthalene deposits, periodically cleaning being, therefore, necessary. The reversable condenser was designed by Dr. Carpenter to meet this difficutty.

Most modern coal gas works include a water-cooled condenser in their equipment. The old Livesey condenser, which consisted of a series of pipes laid in a shallow open trough through which water flowed, has given place to the more economical tube plate type of which the forerunner was the Morris & Cutler design.

The condenser usually consists of a tall cast-iron retangular box, having a vertical division in the center dividing it into two compartments. There is much diversity in the size and thickness of tube employed. The counter current system is invariably employed, and it is usual to send the water through the tubes.

In the condensation of carbureted water gas, the water-cooled condenser generally takes the form of a cylindrical steel shell, with top and bottom tube plate, the gas entering at the top and the water at the bottom.

Dr. Carpenter of the South Metropolitan Gas Company has inaugurated a system of rapid and drastic condensation by means of a reversible water-cooled condenser. Other special means of cooling are dispensed with and the temperature of the gas is brought down from 140° to 50° F. in the one apparatus. A certain amount of tar washing is effected therein by spraying the tar previously condensed. Naphthalene is hereby reduced to a negligible quantity. Many gas engineers would have objected to the loss in the quality of the gas due to the transference of heavy hydrocarbons to the tar, but they are now learning, in these days of reduced candle power standard, that the loss is insignificant, and at any rate, fully recovered when the tar is distilled by the same undertaking.

Great differences are experienced in the amount of cooling required with different systems of carbonization. Naturally, too, the amount of moisture in the coal affects the working. The following tabular comparison indicates what these differences may be with similar coals:

	Horiz ntal or Inclined Retorts Temp. of Gas Degs F.	Intermittent Vertical Reports. Temp. of Gas Degs F.
Hydraulic main, liquor seal	150	...
Hydraulic main, no liquor, no seal	...	450
Foul main. Inlet retort house governor.	130	250
Inlet air condensers	120	170

Tar Extracting.

The last traces of tar are usually removed by a Pelouze and Audouin tar extractor or by a Livesey washer. The former may be said to finish the process of condensation by the removal of tar fog. Some works are fortunate in possessing both apparatus, thereby reducing the content of tar in the gas to a minimum, and consequently facilitating the subsequent processes of cyanogen and ammonia extraction.

The general practice is to employ a washer such as the Livesey for a double purpose, the removal of the last traces of tar, and the concentration of the ammoniacal liquor. The liquor to be strengthened is returned from the final ammonia washers or from the well receiving the liquor from the hydraulic mains, the latter containing a comparatively large proportion of fixed ammonia.

Hydrocyanic Acid Removal.

A fair number of the larger gas works in England now extract hydrocyanic acid from the crude gas. This, in nearly every instance, is done immediately after the tar extractor has done its work, for in the course of ammonia extraction a considerable proportion of the cyanogen compounds is removed. The processes employed are the prussiate and sulphocyanide. The former depends on the intimate contact of the gas with a sludge containing sodium carbonate (soda ash) in solution and "iron mud," generally ferrous carbonate, in suspension.

The favorite apparatus for this purpose is the well known Holmes rotary brush washer; but the ordinary Kirkham washer is also used, as well as vertical centrifugal washers of different designs. Depending on contact and on the strength of solution required (usually from $\frac{3}{4}$ to 1 pound prussiate of soda per gallon) the efficiency varies from 75 to 90%. A few works go the full length of concentrating the liquor and selling the crystallized product at a purity of 99%, others again sell their filtered liquor (or crude cake) to the British Cyanides Co., Oldbury, on the basis of prussiate and ammonia content.

The sulphocyanide process was formerly employed in a similar way as far as the washing is concerned. The sulphur necessary for the chemical reaction was introduced through small hoppers placed over the bays of the washer. The internal wrought iron or steel portions of the washers soon corroded away, however, and in many places the extraction of cyanogen was, therefore, discontinued. Within the last 3 years the Williams modification of the process came to the front, and is now in operation in a good many works. Ordinary cast iron purifier boxes are used, the sulphur being supplied by the spent oxide with which the boxes are filled. The spent oxide is preferably granular and not in powder form, otherwise the back pressure may be excessive. Strong ammoniacal liquor is sprayed on the material to keep it thoroughly wet and active. The efficiency of extraction is generally at least 90% and is frequently nearly 100. The product is sold as a solution having a strength of about 2 pounds to the gallon, the ammonia being about 30 ounces (6%) in strength.

As compared with the prussiate process the sulphocyanide method has the advantage in efficiency of extraction, in working charges, and capital costs; but as the cost of working up the sulphocyanide is high, the price given is very much less than that for prussiate. It is usual to recover from 2 to $2\frac{1}{2}$ pounds of prussiate of soda ($Na_4FeCy_6,10H_2O$) per ton of coal carbonized, as against about 3 pounds in the case of sulphacyanide.

Cyanogen.

Latterly, cyanogen recovery has been a welcome source of profit to the gas undertaking. Its elimination, moreover, facilitates the removal of sulphureted hydrogen by the iron oxide. In one or two instances the extraction is done on the non-ammonia side, where traces of tar may be said to be entirely absent, but where the content of cyanogen is, as previously stated, reduced.

Ammonia Washers.

Following the cyanogen washing plant, come the final ammonia washers. To describe the different types of washers, scrubbers and washer-scrubbers employed in this country would lead us too far. One can only mention the names of the more important types without going into their advantages and disadvantages.

The tower scrubber is still doing useful work on many old established works. Coke filling has given place to wooden grids, which provide a larger surface and do not require so frequent renewal. On modern coke oven works the washing apparatus is still largely of this type. On gas works the shells are constructed of cast iron segments, whilst on coke oven works they are usually built of steel rings riveted together. Tower scrubbers, when of very large size, are worked singly, but it is more usual to work them in pairs. One sometimes sees as many as six in series, but the absorption of pressure is then a serious matter

The general aim is to reduce the ammonia content of the gas to less than 2 grains per 100 cubic feet and to sell, or supply to the sulphate plant, liquor of suitable strength—not less than 6 ounces and as near 10 ounces as possible. To effect this it is necessary to cool the gas to at least 70° F. and use the coldest water available, preferably well water at 50° F. When the water is hard, trouble has in many places arisen through the deposition of encrustations on the wooden filling of the scrubber or washer-scrubber. Replacement of wooden bundles by metal plates, to which the deposits do not adhere so readily, is said to be a remedy for this.

Where the naphthalene content of the gas is high, the admission of very cold water often gives rise to blockages through the formation of crystalline deposits. This is particularly noticeable in tower scrubbers used as final washers. Steaming is usually resorted to as a temporary remedy. Such blockages have been so frequent on some works as to necessitate duplicating the washing plant.

The most satisfactory system of ammonia washing in works where it is thought necessary to recover practically every trace of ammonia, consists in the use of three sets of apparatus; the first set for concentrating the ammoniacal liquor and at the same time removing tar, and the second and third sets, working in series consisting of appliances specially designed to provide the most intimate contact between gas and washing medium without setting up undue pressure.

The first set is usually a simple type of washer working with seal and, therefore, necessarily increasing the pressure a few inches of water column. For this purpose the Livesey washer is probably most commonly used. Other washers applied for the same purpose go by the name of "Young," "Cockey," "Walker," etc.

As finishing ammonia extractor we have, besides tower scrubbers in the older works, various designs of rotary horizontal washer scrubbers, such as the "Chandler," "Creeke," "Eclipse," "Holmes," "Kirkham," "Whessoe," etc These differ mainly in the filling material, which consists of brushes, bundles of thin board or steel plate (plain, corrugated or punched like a grater), wooden balls, or hoop iron wound in spirals. Their effectiveness depends largely on the absence of short circuiting, and this on the faced joints between the revolving collars and the division plates; an exception to this is the "Holmes" brush washer, where no joints of the kind are required, as the brushes bear on the division plates. In the best designs the apparatus is divided into at least eight bays, the lower halves of which contain liquor, whose strength naturally increases from the gas outlet, where water or weak liquor is running in to the gas inlet, where strong liquor overflows. The shaft, which requires to be 6 or 7" in diameter for the larger machines, makes from 2 to 5 revolutions per minute. The usual section is circular, in older patterns ⊃ section; it is now sometimes made square for superimposing one above the other, and thus saving ground space.

In Walker's purifying machine, the movement of the scrubbing material is vertical, not rotary.

Of vertical centrifugal washers, of which a considerable number have already been erected in this country, the "Feld" was the first to make its appearance on gas works. Though apparently very promising, this type did not meet with much success, but others of improved design, such as the "Kirkham," have found more favor. The efficiency in this case depends on the spraying effect and the number of superimposed washing chambers. Advantages are claimed in cheapness, saving of ground space and power, freedom from blockages and reduced back pressure.

In the selection of a washer or scrubber of any kind, it has been found most important to provide a good margin in capacity. This is all the more necessary in many works on account of the installation of new plant that has taken place. The writer has in mind several instances where, in addition to the ordinary appliances, P. & A. tar separators, cyanogen washers and naphthalene washers have been erected, increasing the back pressure to the extent of 9 or 10", and thereby augmenting the load on the exhausters to a serious extent.

The process of direct recovery of ammonia by washing the hot tar-free gas with sulphuric acid, as carried out on a number of coke oven works, has not yet made much headway in gas works.

Naphthalene.

Finally, reference must be made to the methods found successful in British gas practice in dealing with the naphthalene difficulty, which began to be felt very accutely 10 or 12 years ago, though more in the district of supply than on the works. Reduction of the naphthalene content, either before or after the purifiers, by wash-

ing with a special creosote or anthracene oil, or with water gas tar, is practiced in many places. The renewal of the solvent has to be maintained. Probably it is the more usual method, however, to add the vapors of middle oils, boiling between 140° and 200° C., to the gas in sufficient quantity to accompany the naphthalene, so that when condensation takes place the solid hydrocarbon is kept in solution, thereby allowing it to run to the drip boxes (syphon pots) connected with the mains and services. The quantity to be thus evaporated varies from 10 to 20 gallons per 1,000,000 cubic feet of gas. The apparatus employed for either method is usually a Livesey washer, although some engineers prefer to use two or three bays of a rotary washer. Spraying oils into the stream of gas has been practiced in a few places, and more recently a simple form of steam heated vaporizer of naphthalene solvent has been used with successful results.

Report of the Industrial Fuel Committee, N. C. G. A.

By S. Tully Wilson.

Since the formation of this Association, you have had each year, papers on Industrial Fuel, its possibilities and its problems.

You have had special Industrial Fuel Committees and they have had papers prepared which require much time and effort on the part of the writers. They proved of great value to those who absorbed them, but they were spread upon the minutes and then forgotten. The discussion of the papers has been animated and extremely interesting. The differences of opinion, sometimes pronounced and often ended without final decision; but these subjects were seldom brought up at subsequent meetings, for the new committee always had new work to do.

It has been apparent for some years that such work should be taken up systematically, and the efforts of these men, who are specialists in their profession, saved and made available for the new men who must be called in to assist in securing this, the most lucrative, the most desirable new business available to the gas company.

It was a problem to determine just how this result could best be accomplished. A hand book was proposed several years ago, and several industrial fuel committees spent much time in accumulating data, for it. This work went into the hands of a special committee this year, which has produced the first edition of a valuable reference book. To the uninitiated this might appear to be enough, but it will not take long to convince the most skeptical that a hand book can, at its best, only touch upon the vast amount of information required by the industrial fuel man.

There is a prospect for industrial appliances wherever heat is used in a manufacturing process; and the industrial man is expected to approach every kind of a "prospect" and secure his order for gas appliances. How is he able to advise a manufacturer of a certain product, what to use? The manufacturer says, or thinks, "what do you know about my business?" and the salesman thinks "I don't know half as much about his business as I would like to; and where will I find out?"

Suppose the manufacturer wants to dry soap, or perhaps fish. The fish will stand very little heat; the weather is damp, perhaps raining, how can it be done?

You all know that heat facilitates drying; that air in motion is more desirable for drying than air at rest But the industrial engineer is expected to know all about it. Where will he find out? Not from a hand book. If the information on this subject that the engineer requires, were available in any book, it would be necessary to refer him to the book, or copy the data into the hand book. But, until now, it was only possible to find it by a long and tedious search of the libraries, aided by a broad knowledge of physics, and above all, wide experience.

Then he is supposed to know all about japanning, lacquering, melting soft metals and brass and copper, about coloring and heat treating metals, and a thousand other uses for gas. You all, I believe, acknowledge that there are at least one thousand uses for gas.

Gas fuel engineering has been most seriously handicapped, because no literature has been available that would give data and information directly applicable to the gas problems. This committee felt that the greatest good would accrue to the Association by supplying some of this material, and the members have devoted their own time and *much of it*, to accomplish some of this work.

We have prepared seven booklets covering some of the subjects most often met with. The editor of each volume was selected because of his special knowledge of that particular subject, and he has been assisted by all available talent and references. Each has collected data from papers presented to the Association in the past, from trade journals, from manufactures and, in fact, every available source. At this writing it appears that one or two of the pamphlets will not come from the printers in time to show them to you here; but the copy for seven has been received.

These books are practical treatises on the application of gas to—

1. Dry Room Equipment.
2. Japanning and Lacquering.
3. Steam Boilers.
4. Metal Coloring.
5. Soft Metal Melting.
6. Hotel and Restaurant Equipment.
7. Heat Treating Tools and Cutlery.

They are, we believe, of much greater value to the Association than papers presented by individuals. They should be studied and kept for reference. They should be distributed freely to your various prospects.

For example, booklet number two will be prized by every manufacturer who uses japans and lacquers; he will need it, and preserve it, and he cannot avoid seeing the advantages of using gas. This applies as well to the other booklets.

Those of you who have your manufacturers carded will, I believe, be greatly benefited by presenting a copy of the book applicable to their work, to them. It will show that the gas engineer is especially interested in their work, and knows something about it. It will pave the way for the salesman and give him entrè where it would not otherwise be accorded. It is not often that you are able to present to a foreman or superintendent something of direct value to him that does not look like a bribe.

These books will be accepted and valued.

The fertile brain will think of many ways of making capital of this plan.

The Industrial man who meant to succeed has had to search libraries and interview appliance manufacturers, in order to familiarize himself with each manufacturing process.

This year, he has definite and authentic information on the subjects treated in these reference books.

The Educational Course will give him the foundation to build on: The Salesman's Hand Book is available for reference when tables are required: and these Treatises will finish him on their respective subjects, and enable him to approach his prospect with confidence backed by knowledge.

It is appreciated by the committee that these first editions probably contain errors and omissions; but the fundamentals are there, and are invaluable to the commercial organization.

An explanation of why these particular subjects were selected may be desired. At one of the early meetings of the Industrial Fuel Committee a list was made of the twenty most important subjects to cover. Then the members were asked to suggest names of those men most capable of editing each subject. Of those selected, a few undertook and accomplished their allotment of work. They have been generous in supplying the information they have spent years in accumulating, in making available to the novice and to the commercial organization their knowledge and experience.

The Committee anticipates that the work will be continued, that new subjects will be covered as rapidly as possible, so that a treatise will soon be available for every broad subject. We want these first treatises revised and kept up to the minute, and for this reason have only a small edition of each printed. The initial work has been tedious, but the members are confident that the work is valuable and that a successful start has been made.

These treatises should be bought and placed in the hands of each New Business Manager, of each salesman who interviews industrial prospects, and of each prospective customer particularly. They should be put into the hands of every student taking the N. C. G. A. Industrial Fuel Course.

We want and expect your co-operation and support, the quick absorption of this edition will add vigor to the editing of new and varied editions; it will be a great incentive for more capable men, to do more and even better work.

You commercial men are the ones most benefitted; you are the men this work has been done for. You will only get more by showing your full appreciation of what has been done. This is not said because I anticipate any lack of appreciation; but because it is getting harder each year to get the best men to give so much of their time gratituously to the Association. The men who have worked this year should receive lasting recognition, and this is the recompense that all good men work for.

Newark Knows How.

Once more the Newark office of the Public Service Corporation of New Jersey has demonstrated that it can live up to the slogan of the city, "Newark Knows How." The illustrations show the exterior of the Public Service Building, Broad street, Newark, and a view of the salesroom on the main floor, decorated for National Prosperity Week.

For the past year or more this Show Room has been operated along the lines used by the department store.

The local agent, Mr. W. M. Halsey, is a great believer in a change of display, and this has been done weekly. Mr. J. L. Thomas has charge of the floor and attends to the interior arrangements, and Mr. S. H. Alexander takes care of the windows.

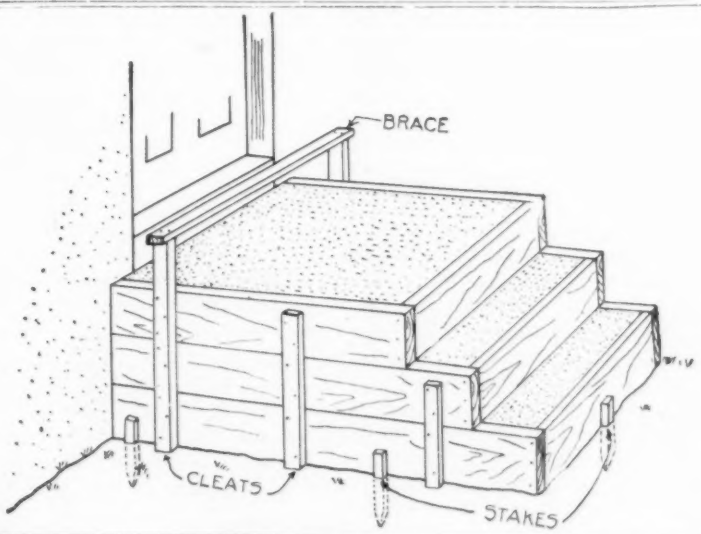
The weekly change referred to means a complete rearrangement over the entire floor with the exception of the lighting fixtures. The floor space is divided between gas and electric appliances, and a window devoted to each. The things which are especially suitable are, of course, featured, and large readable price tags are used on all specials.

The sales of appliances have demonstrated that the time and attention given the displays, brings commensurate returns.

Electra's charms and abundant decorations, added to the enormous quantity of advertising during National Prosperity Week did not bring the sales of electrical appliances up to an amount equal to that of the gas division.

New Methods and Appliances.

SIMPLE CONCRETE STEP CONSTRUCTION.—Steps are not only subject to hard usage; but when constructed of wood with the lower part in contact with the ground and subject to alternate wetting and drying, decay is very rapid, making them unsafe; but it is easy to have them durable and safe by making them of concrete. A simple method of doing this is shown in the accompanying cut. The three forms are merely that many boxes, without top or bottom, and open at the end adjoining the door-sill.



Simple Forms for Constructing Concrete Steps.

A rise of 8″ and a tread of 10″ are convenient, and therefore the height of each box should be 8″, since every box will form a step. All of the boxes should be of the same width, but each one is 10″ shorter than the one beneath it, thus forming the tread of the step. If the steps are few in number and not too wide, 1″ boards will be stiff enough to hold the concrete without bulging, but if there is any doubt it is better to use 2″ plank. The concrete should be mixed in the proportion of 1 bag of Portland cement to $2\frac{1}{2}$ cubic feet of clean coarse sand and 4 cubic feet of crushed rock or pebbles. The earth beneath the steps should be excavated 6″ below the surface, the exact size of the bottom step. Place the largest box in position around the edge of the excavation, staking it in place at two or three points, and level it very carefully. The concrete, mixed rather dry, should be deposited in the box and thoroughly tamped and compacted until moisture rises to the surface. Work it thoroughly along the sides of the forms so as to produce a smooth surface. At the front end of the box, where the concrete becomes the tread of the step, the surface is carefully leveled off and smoothed with a trowel. Immediately after this is done the second box is placed on top of the first and fastened by a few nails through the upright cleats. The nails must not project into the concrete. Fill the second box with concrete immediately, being careful that there is no dirt on the surface of the first batch of concrete to prevent a good bond between the two layers. Finish this slab exactly as described for the first step. The last step is constructed in the same way. The brace between the two back cleats is to prevent the boards from spreading at the side next to the wall. The surface of the top step is carefully leveled with a straight-edge and finished by troweling to a smooth surface. Excessive troweling, however, must be avoided. Not more than a half hour should elapse between placing the concrete for successive steps. After the steps are about one week old, the forms may be removed and the steps used; and any roughness or irregularities smoothed down, and the surface of the steps finally finished by rubbing with an old piece of emery wheel and water. Where the work includes many steps, a hollow space is generally left under the main body to effect a saving in materials. Where this is done the platform and steps are reinforced with steel rods or heavy wire mesh.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

WILLIAM J. BARKER, vice president and general manager of the Denver Gas & Electric Light Company, has been made a member of the advisory and employment board of the Y. M. C. A. of that city, which is composed of business men who devote one evening a week to personally advising young men as to possible vocations.

THE Progress Club, composed of employees of the Lansing Fuel & Gas Company, elected these officers at its annual meeting: President, Mathew Rapp; vice president, T. B. Ordish; secretary, Arthur N. Avery; treasurer, Miss Lottie Wilder. Directors, and various committees, also were named. Meetings will be held the third Thursday of each month. The next meeting being Jan. 20.

A. K. KLINE, Assistant Commercial Agent, Brooklyn Union Gas Company, has been transferred to the Flatbush office. His successor at Jamaica is Jackson Duff. E. C. Lackersteen, formerly at Flatbush, goes to Newtown. These changes were mainly due to the large increases in the commercial business of the company.

THE Wisconsin Gas and Electric Company has broken ground for a $75,000 addition to the retort house of the Racine Gas Light Company. The new building is to be ready for occupancy by the first of next July and with its completion the capacity of the plant will be largely increased. The building has been made necessary by the large amount of gas the company is now sending from Racine to Kenosha, Corliss, and other points. With the increase in the Racine plant there is little reason to believe that the old gas plant in Kenosha will ever be utilized by the company, as it has been found cheaper and more satisfactory to supply gas from Racine.

SOME 600 employees of the United Gas Improvement Company, at their recent Safety Rally formed a "Light Brigade." Its object being to perform their daily tasks so carefully that no injuries would result. The motto of the new "Light Brigade" is:

Theirs was to reason why,
Theirs was to do, not die;
Careful Six Hundred!

The men took a pledge, at the instance of Samuel T. Bodine, president of the company, by rising to their feet and raising their right hands, to support the work of John Price Jackson, State Commissioner of Labor and Industry, by doing all they could to prevent accidents.

CONFIRMATION is given of the sale of the gas plants in sixteen Ohio and Indiana cities to a New York syndicate, of which C. H. Geist is the head. The plants are located in Fort Wayne, Logansport, Lafayette, Peru, Wabash, Lebanon, Frankfort, Decatur, Bluffton in Indiana, and Lima, St. Mary's, Wapakoneta, Fort Recovery and Coldwater in Ohio.

THE second annual dinner of the New Business Club of the Public Service Gas Company was held on the evening of December 9 at Hotel Greely, Newark, N. J. The toastmaster Louis J. Platt called upon the president A. J. Phillips, H. D. Gillingham, B. K. Johnson, and W. W. Barnes, all of whom responded in not too serious vein. The officers for the coming year are as follows: President, A. J. Phillips; vice-president, A. F. Hacker; secretary, N. P. Van Brunt; treasurer, W. K. Terriss. Trustees: T. J. Keane, M. Byrne, P. Rowlenson, H. M. Sklar.

"IT is going to be an open winter," said Superintendent John Hellen of the Grand Rapids Gas Light Company. "Working where there are lawns, we have found angleworms near the surface of the ground This is a sure sign of an open winter, for if it was to be a hard winter the worms would be down deeper in the earth."

THE Peoples Gas Light and Coke Company of Chicago gave Christmas turkeys to 5,000 employees, as it has done for nearly thirty years, and a Christmas party for the children of employees on Saturday afternoon with a Christmas tree.

THE Portland (Ore.) Gas and Coke Company is to be required to pay the $10,000 it will cost to move its gas mains with the lowering of the tracks of the O. W. R. & N. when the grade crossings are eliminated between the head of Sullivans' Gulch and the city limits. This conclusion was reached at a conference of the City Engineer with the City Attorney. Originally it was planned to include this cost in the assessments to be paid by the railroad companies and the property benefitted.

THE Consolidated Gas, Electric Light and Power Company of Baltimore has declined the offer of the Columbia Gas and Electric Company to furnish natural gas from the West Virginia fields at 28 cents a thousand. The Columbia people are expected to take other steps to get into the Baltimore market.

MR. W. R. FURLONG, Secretary and Treasurer of the gas and electric companies at Albany, N. Y., was one of the Deeper Hudson Waterways Cammittee that presented a petition to President Wilson, in Washington.

"PUBLIC Service Companies and the Folks they Serve," was the subject of an address delivered by G. D. Gold, at the monthly dinner of the New England Section of the National Commercial Gas Association, held at the Boston City Club, on December 17th. C. E. Paige, of Malden, presided.

ABOUT two years ago the W. M. Crane Company, of New York, owners of the New Bern (N. C.) Gas Company, and the gas company at Goldsboro, sold their holdings to the International Gas and Electric Company, of Philadelphia. The latter having defaulted in their payments, the property has reverted to the former owners. The following officers of the company have been selected: William M. Crane, president; L. I. Moore, vice-president; and George Vaughn, secretary. John Palmer, who has been superintendent of the New Bern plant for several years, was reappointed to that position.

THE Western Gas Construction Company has completed alterations and repairs costing nearly $5,000 to the storage holder of the Altoona (Pa.) Gas and Fuel Company.

RESIDENTS of towns from Narberth to Berwyn (Pa.) will get a Christmas present from the Counties' Gas and Electric Company, a branch of the United Gas Improvement Company, in the form of a reduction in the rate of gas. The new rate, beginning at $1 per thousand net, will graduate to seventy cents. The old rate is $1.10 to ninety cents per thousand net. According to John L. Mather, superintendent of the company, the reduction is in line with the company's policy of making reductions whenever volume of business and financial conditions warrant.

THE Municipal Lighting department Westfield (Mass.) has in store all the fuel that it will need for the coming winter. The repair work on the two gas holders has been completed, but work on the new storage and oil tanks has not been started because all of the bids received called for more money than was appropriated. New plans have been drawn and work will be started as soon as suitable bids are received.

AT a meeting of the Council of the Iowa District Gas Association, held December 10th, it was decided to hold the next annual meeting at Dubuque, Ia., May 17, 18 and 19, 1916. Further information will be forthcoming as soon as arrangements have been made.

PUBLIC service corporations in Bridgeport, Conn., have begun to prepare for the conditions the city's growth will cause. The Bridgeport Hydraulic Company announces it has purchased 70 acres of land on Johnson's Creek, and it is understood that it will re-sell part of the land to the Bridgeport Gas Light Company, as a future site for a big container, to furnish gas to the eastern section of the city.

THE "Doherty News" says: "The ready market for naphthalene has caused Doherty properties to take stock of their prospects in that line. As a result the Spokane Gas and Fuel Company finds that its large accumulation of tar should yield naphthalene to the extent of $25,000."

THE new rates for Norristown, Pa., are:

First 10,000 cubic feet, or any part thereof, per month, at $1.10 per 1,000 cubic feet, net	$1.00
Next 20,000 cubic feet, or any part thereof, at $1, net	.90
Next 20,000 cubic feet, or any part thereof, at 90 cts., net	.80
Over 50,000 cubic feet, per month, at 80 cents, net	.70

Minimum charges, 30 cents per month.

THE question of a gas franchise for the New Orleans suburb of Gretna, has been revived, application for the privilege having been made to the Mayor and Aldermen. A special meeting will probably be called to pass on the ordinance. One feature that seems to have stirred up some opposition is that the proposed ordinance calls for a 50-year franchise.

LONG BEACH, Cal., will resist the order of the State Railroad Commission allowing the Long Beach Gas Company to raise its rates 25 cents per 1,000 cubic feet. The city attorney was instructed to prepare papers in a strenuous protest against the rise, and make an application to have the old rate of $1 per 1,000 cubic feet restored, pending the hearing of the application for a readjustment.

THE Waynesboro, (Pa.) Gas Company advertises: "In selecting your Xmas gifts, please remember that nothing will be more useful, ornamental and sensible than a Gas Light, a Gas Stove, a Gas Library-Heater, a Gas Iron, or one of our many economical Gas Appliances. We will hold your purchase in stock until requested to deliver and install same. We guarantee satisfaction."

HERE is a funny one from the Buffalo, N. Y. "Express:" Mayville, Dec. 13 (Special).—Mayville residents have suffered from a shortage of gas in the last few days. Some, who believe that there is sufficient gas to be had for local needs are indignant. Candles were used to light the office of the gas company last Friday night to enable clerks to see to receipt gas bills. There was a rush of patrons, because it was the last day the discount was allowed.

THE Lewiston, Me., aldermen have voted to request the Public Utilities Commission to investigate the books and records of the Lewiston Gas Light Company, with a view of ordering a reduction of the price of gas to $1 per 1,000 cubic feet. The present rate is $1.40, with a discount of 10 cents per 1,000 if paid before the 10th of the month.

AN appreciation: "In keeping with the holiday season, the Newburyport (Mass.) Gas and Electric Company, has added to the attractiveness of the business section of the city by a very pretty and interesting window decoration at its office on Pleasant street. The scene is a true winter picture, the ground covered with snow and a railroad train is bringing home the sons and daughters for the holidays. The railroad station and the high hill with children coasting on sleds, adds to the charm of the picture. The company is engaged in a very active campaign to serve the public with its products, and is giving the best service the city has ever enjoyed."

"MUSKEGON HEIGHTS, Mich., will be burning gas by the first of next June," is assured by A. E. Dunn of Ann Arbor, promoter of the company. He announces that the $20,000 stock has been subscribed, and papers of incorporation filed with the Secretary of State. The franchise was granted fully a year ago, and because of the time limit, requiring that the plant be completed by June 1, and the mains laid, construction will commence as soon as the weather permits. According to present arrangements, there will be 10 miles of line laid. Solicitors will cover the entire city and the convenience of gas will undoubtedly be placed in nearly every residence. The latest types of apparatus will be installed in the gas-making plant, and a high pressure system used.

SAMUEL INSULL, president of the Public Service Company of Northern Illinois, recently appeared before the public utilities commission to answer charges that his company is illegally organized, that there is an interlocking directorate with other companies, that it is over capitalized, that excessive salaries are paid to the officers, that the company is violating its charter in selling merchandise; and that because of these things its gas rates are exorbitant.

UTILITIES COMMISSION NEWS.

ILLINOIS COMMISSION ON DEPRECIATION AND GOING VALUE.—The State Public Utilities Commission of Illinois has entered an order in the case of the Belleville Electric Company, which provides for the highest valuation yet allowed in that State on the property of a public service utility for rate making purposes, $350,000. A few weeks ago the gas property of the St. Clair County Gas and Electric Company, was valued at $265,000, making the total for both gas and electric properties, $615,000.

The Commission has taken a stand on a few debatable questions in rate-making proceedure. For instance, in estimating depreciation on this electric property, the Commission finds 4.4% per annum equitable and just. The Commission states regarding depreciation:

"It was argued by the respondent that the reproduction cost new (undepreciated) is a proper and equitable value for rate-making purposes. The reasons advanced are (1) that reproduction cost is the amount of money which would necessarily be expended by a utility in duplicating its plant, and (2) that, from a consumer's point of view, a well-operated utility is delivering 100% service and is hence in 100% condition, irrespective of actual deterioration of the physical plant. If there is justifiable grounds for such an argument, it must be based upon real reasons, and not upon a mere desire of the owners of the property to maintain its paper integrity. The advocates of the theory would hardly admit that any need of actually duplicating the property will ever arise, or, if such need were to arise, that the property would be duplicated in the same identical manner, despite modern efficiency and economy, and despite scientific development in the art. The fact must be faced that property does depreciate in value with age, with use, with changes in the art, and with increases in load. A very vital element in the value of equipment lies in the fact that it probably has ahead of it certain years of effectiveness in the operation for which it was intended. As the period of potential operation is increased or decreased, the value of the equipment, as a portion of the operating property, is correspondingly enhanced or diminished."

The question of going value is argued at considerable length. 'It would appear that claims for 'going value' should be supported by proof of its existence. * * * The respondent herein has recorded no proof of the existence of any 'going value' during early operations. Although the courts have not stated explicitly what should be included in a consideration of 'going value,' certain exclusions have been passed upon, and 'good will' has been excluded."

The commission finds the St. Clair County Gas and Electric Company entitled to a 7¼% rate of return on a fair value of its property; approximately equivalent to an 11% rate of return upon a proper stock issue.

NEW YORK APPOINTMENT.—Governor Whitman has appointed Oscar S. Straus, former United States Minister to Turkey, afterward Secretary of Commerce and Labor, and Progressive candidate for Governor of New York in 1912, as Chairman of the Public Service Commission for the First District, to succeed Edward E. McCall, removed. This is one of the very few appointments that measure up to what Commissioners were expected to be—men of more than average caliber.

Indications are that at least one other New York Commissioner may be removed on charges, and there will be a vacancy on February 1st, by the expiration or the term of Commissioner Cram.

LIABILITY FOR DAMAGE FROM SETTLEMENT OF TRENCH.—A city maintained a series of wooden flumes to irrigate its park system. A heating company, by permission, laid steam pipes under the flumes to the depth of four or five feet. The laying of the steam pipes caused the flumes to sag and leak, permitting water to percolate upon the steam pipes, and cause excessive condensation. The heating company brought an action for injuries caused. Held, that the injury, being the result of natural conditions, the probability of which was known to plaintiff at the time it obtained the franchise, was not actionable.—Yakima Central Heating Co. vs. City of North Yakima, Wash.

Financial Notes.

EARNINGS of $44,228.78 on a capital stock of $60,000, are shown in the annual report of the ADAMS GAS LIGHT COMPANY. The earnings equal 77,048% of the capital stock, and dividends amounting to 21% have been declared. The earnings are distributed as follows:

Interest paid	$3,103,94
Dividends declared	12,600.00
Depreciation	3,247.21
Other items	3,386.71
Balance	21,891.92
Total	$44,228.78

Management charges totaling $8,521.77 are shown, $3,265.75 for gas and $5,256.02 for electricity. The manufacturing account included in the report shows the experience of the year:

Operating expenses (gas) at works	$72.50
For distribution	2,590.17
Management	3,265.75
Taxes and incidentals	975.55
Gas bought	14,323.66
Total	$21,227.63
Operating expenses (electric) at station	$6.35
For distribution	3,822.42
Taxes and incidentals	1,972.19
Management	5,256.02
Current bought	9,700.70
Total	$20,257.68
Income from sales of gas	$24,477.11
Sale of electric light and power	34,621.79
Other sources	1,780,06
Total	$60,878.96

SUIT has been filed by the CENTRAL TRUST COMPANY of Illinois, against the SHERMAN (Tex.) GAS LIGHT AND FUEL COMPANY asking for a receivership. W. M. Claffin, Jr., has been appointed receiver. It is said that the suit is of a friendly nature. In the petition the plaintiff alleges that it is trustee under a deed of trust executed by the gas company covering a proposed bond issue of $200,000; that bonds to the extent of $175,000 have been sold and are now outstanding; that the interest due on said bonds on May 1, 1915, has not been paid. The defendant company has been manufacturing gas in Sherman for about thirty years and until the advent of natural gas in that city did a flourishing business.

THE DIRECTORS OF THE HARTFORD CITY GAS LIGHT COMPANY have elected Frank C. Sumner a member of the board, to succeed the late Sylvester C. Dunhan; and declared a quarterly dividend of 2% on preferred stock and 3% on common, with 1% extra on common, payable to stockholders of record December 31. The annual meeting of the company will be held January 18.

THE PACIFIC GAS AND ELECTRIC COMPANY has applied to the California Railroad Commission for authority to issue an additional $2,500,000 of its 6% first preferred stock at not less than 90. The first issue of this stock. totaling $12,500,000, was sold—$6,039,600 to stockholders and $6,460,400 to employees and others than stockholders.

THE GLOUCESTER GAS LIGHT COMPANY has filed a petition with the Massachusetts Board of Gas and Electric Light Commissioners asking for authority to issue 2340 additional shares of capital stock of the par value of $50, the proceeds to be applied to the payment of the floating indebtedness of the company incurred in the enlargement of its plant and extensions to its distributing system, and also for further proposed enlargements and extensions.

AS a result of the sale of the Majestic Building, at a reported price of $340,000, by the INDIANAPOLIS GAS COMPANY, leased to and operated by the Citizens Gas Company, an extra dividend of 10% has been declared by the company, in addition to the regular 2%. According to stockholders, the company will declare another extra dividend, probably 5%, in February, when another installment of the purchase price of the building is paid. This sum will leave about $40,000 to be paid on the purchase price, which will call for another dividend of 2% or more.

THE ELECTRIC BOND AND SHARE COMPANY has purchased from the Utah Securities Corporation the $3,000,000, par value, 7% cumulative preferred stock of the Utah Power and Light Company.

AN issue of $1,021,000 of the Rockford (Ill.) GAS LIGHT AND COKE COMPANY first refunding and consolidated 5% bonds, due in 1959, has been purchased from the American Gas Company by Bioren and Co. and E. B. Smith and Co., of Philadelphia. The bankers have resold the bonds at 96½ and interest.

THE application by the WESTERN UNITED GAS AND ELECTRIC COMPANY of Aurora, Ills., for an order authorizing the issue of approximately $900,000 of its general mortgage bonds, has been heard by the State Public Utility Commission. It is expected a favorable order will be issued.

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When advertising pays!

A manufacturer makes a success by producing something better than any competitor.

All successful manufacturers bring out new goods which supersede their old lines.

An old established concern can obtain satisfactory results by keeping their name conspicuously before the fraternity. A new concern must make its reputation by telling of the superiority of its product until it becomes a standard. An old established concern increases its prestige by telling of new developments.

When you keep your name before the buyer and tell him the NEWS about your goods your advertising will pay.

Send us your copy.

The American Gas Light Journal

DIDIER-MARCH COMPANY

WORKS: KEASBEY, PERTH AMBOY, N. J. OFFICE: PERTH AMBOY, N. J.

INSTALLATIONS OF GLOVER-WEST VERTICAL RETORTS THROUGHOUT THE WORLD

	Capacity cubic feet per diem. Millions.
St. Helens 1st installation	¼
2d "	1¼
3d "	2
Manchester 1st installation	½
2d "	4
Rochdale	1¼
Tokio	1¾
Lurgan	¼
Helensburgh	½
Sydney (N.S.W.) 1st installation	1¾
2d "	1¾
3d "	6
Bradford	2
Fitchburg (U.S.A.) 1st installation	¼
2d "	¼
Newcastle (N.S.W.)	1
Belfast 1st installation	2½
2d "	5½
Nelson 1st installation	1¼
2d "	1¼
Blackpool 1st installation	¾
2d "	¾
Stockholm (Sweden)	1½
Bergen (Norway)	¾
Newcastle-Upon-Tyne 1st installa'n	2½
Newcastle-Upon-Tyne 2d installa'n	3
Heywood	½
Darlington	2
Oldham	2
Bridgwater	½
Southport	1¼
Cambuslang	½
Nottingham	1½
Tipton	½
Leicester	2½
Exeter	1¼
Barnoldswick	½
Coteborg (Sweden)	1
Cape Town (South Africa)	½
Hong Kong (China)	¾
Berlin (Germany)	¼
Liverpool 1st installation	2½
2d "	2½
Macclesfield	1
Lytham	½
Dunoon	⅜
Pawtucket (U.S.A.)	1
Montreal (Canada)	4
Ottawa (Canada)	1½
Grays & Tilbury	½
Bangor (Ireland)	⅜
Brisbane (Queensland)	1½
Northampton	1¼
Cardiff	2½
North Sydney (N.S.W.)	2½
Bothwell & Uddingston	¾
Springfield (U.S.A.)	1½
Preston	1¼
Portland (U.S.A.)	1
Santos (Brazil)	¾
Lea Bridge	1
Pernambuco (Brazil	¾
Chorley	1¼
Swindon	½
Rochester	1¼
Rothesay	½
Napier (New Zealand)	½
Salford	1¼
Lemberg (Austria)	½
Rhmney & Aber Valleys	½
Holywood	¼
Blyth	1
Stafford	1
Zaandam (Holland)	¾

COMPLETE COAL GAS INSTALLATIONS of all designs. RETORT HOUSES. COAL AND COKE HANDLING MACHINERY. HIGH CLASS REFRACTORIES MATERIALS. GAS BENCH AND COKE OVEN SETTINGS. LININGS FOR WATER GAS SETS AND CUPOLAS.

CHAMBER OVEN SYSTEM

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RESULTS IN OBTAINING

HIGHEST YIELD OF GAS
LOWEST NET COST STORED IN HOLDER
MAXIMUM YIELD OF AMMONIA and TAR OF BEST QUALITY
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BEST GRADES OF COKE PRODUCED
OF DOMESTIC OR METALLURGICAL AS DESIRED

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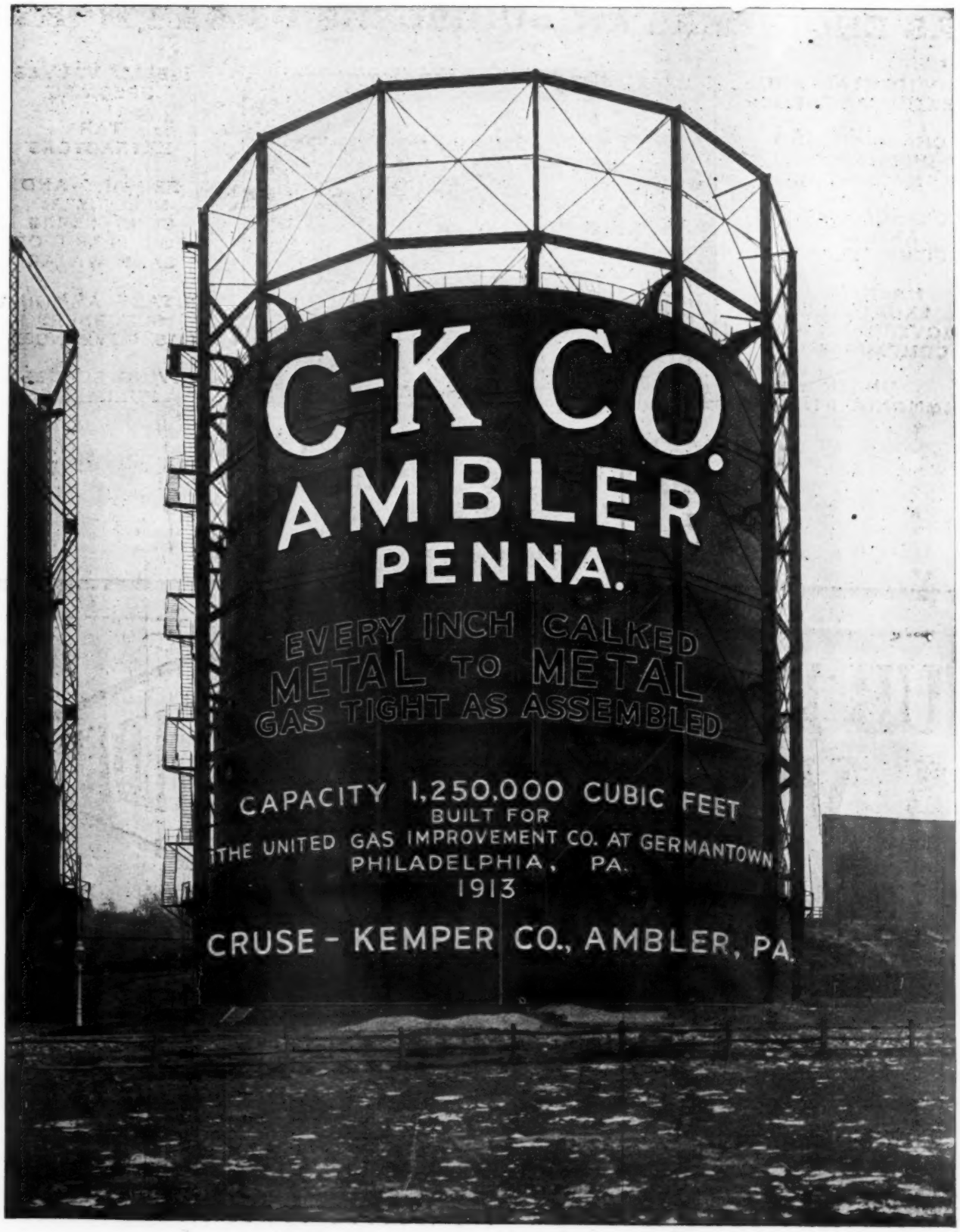
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EVERY INCH CALKED
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GAS TIGHT AS ASSEMBLED
CAPACITY 1,250,000 CUBIC FEET
BUILT FOR
THE UNITED GAS IMPROVEMENT CO. AT GERMANTOWN
PHILADELPHIA, PA.
1913
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R. K. WEHNER
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COKE CONVEYORS AND COKE SIZING PLANTS

MACKENZIE EXHAUSTERS GOVERNORS AND COMPENSATORS

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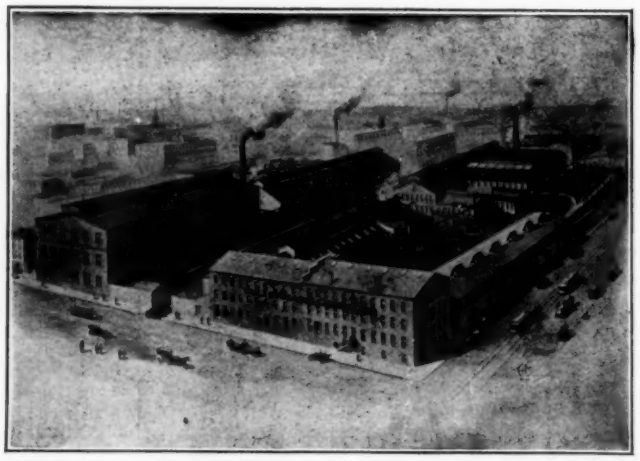

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PRIMARY AND SECONDARY CONDENSERS FOR FRESH OR SALT WATER

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ESTABLISHED 1865

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No. 238

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Proper street lighting creates a spirit of pride on the part of local business interests as well as good impressions from outsiders. This impression carries through even to those business concerns in well-lighted towns. It bespeaks progressiveness, and progressiveness bespeaks credit.

Street lighting by gas is in itself an asset to any community when rightly maintained. It is the exclusive business of the Welsbach Street Lighting Company of America to take such good care of gas street lighting that it is really a "credit." For years we have been building up through experience and investigation a service which undoubtedly can surpass any other that can be secured.

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NEW YORK. BUFFALO. CHICAGO. ST. LOUIS. BOSTON. SAN FRANCISCO.

PUBLIC LIGHTING TABLE FOR JULY, 1915.

COMMUNICATED BY THE AMERICAN METER COMPANY.

Day of Week.	MOONLIGHT SCHEDULE.		
	Date.	Light.	Extinguish.
Thursday	1	8.00 P.M.	11.40 A.M.
Friday	2	8.00	12.00
Saturday	3	8.00 L.Q.	12.20 A.M.
Sunday	4	8.00	12.40
Monday	5	8.00	1.10
Tuesday	6	8.00	1.40
Wednesday	7	8.00	2.10
Thursday	8	8.00	3.40
Friday	9	8.00	3.40
Saturday	10	8.00	3.40
Sunday	11	8.00 N.M.	3.40
Monday	12	8.00	3.40
Tuesday	13	8.00	3.40
Wednesday	14	8.00	3.40
Thursday	15	8.00	3.40
Friday	16	9.40	3.40
Saturday	17	9.10	3.40
Sunday	18	9.30	3.50
Monday	19	10.00 F.Q.	3.50
Tuesday	20	10.30	3.50
Wednesday	21	11.20	3.50
Thursday	22	12.10 A.M.	3.50
Friday	23	1.10	3.50
Saturday	24	2.30	3.50
Sunday	25	No L.	No L
Monday	26	No L. F.M.	No L.
Tuesday	27	No L.	No. L.
Wednesday	28	7.50 P.M.	9.40 P.M
Thursday	29	7.50	10.00
Friday	30	7.50	10.20
Saturday	31	7.50	11.40

Established 1858 Incorporated 1890

CHAS. E. GREGORY, President — DAVID R. DALY, Vice-President and Treasurer — H. D. ABERNETHY, Secretary

J. H. GAUTIER & CO.

Jersey City, N. J.

COAL GAS BENCHES

SILICA RETORTS AND SETTINGS

Clay Gas Retorts, Fire Brick, Water Gas Linings, Etc.

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BY H. P. GILLETTE. 1,854 PAGES. $5.

A reference book giving methods of construction and actual costs of material, labor and equipment on all classes of civil engineering and works. Divided into sections under following heads: Principles of Engineering Economics and Cost Keeping—Earth Excavation—Rock Excavation—Roads, Pavements and Walks—Stone Masonry—Concrete and Reinforced Concrete Construction—Water Works—Sewers—Timber Work—Buildings—Railways—Bridges and Culverts—Steel and Iron Construction—Engineering and Surveys—Miscellaneous Cost Data.

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Silica or Fire Clay Benches.

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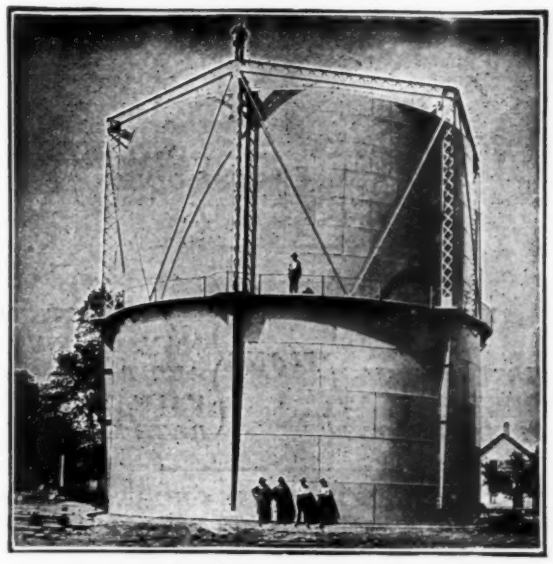

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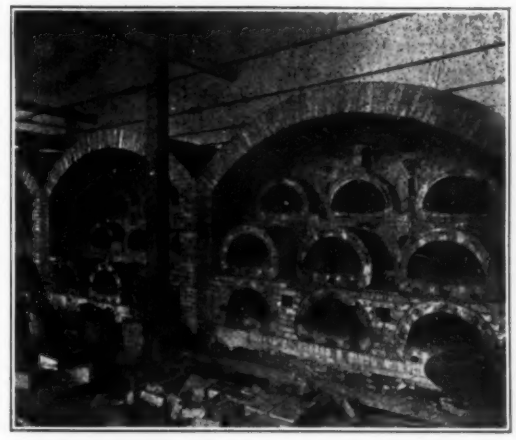

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WATER GAS		*CONSTRUCTION*
OIL GAS		*MANAGEMENT*
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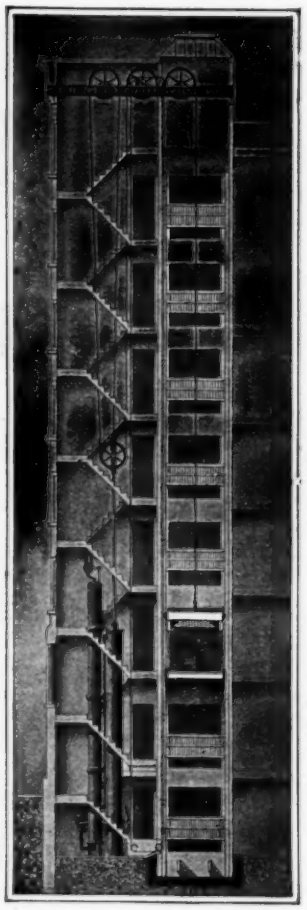

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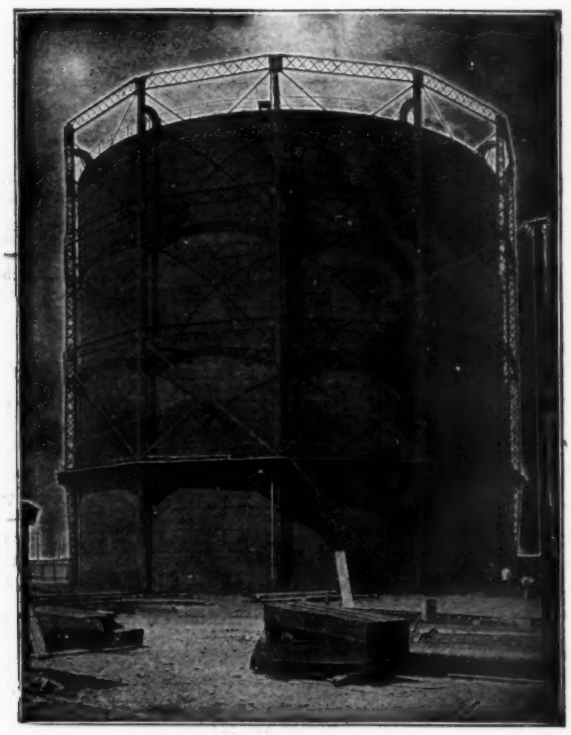

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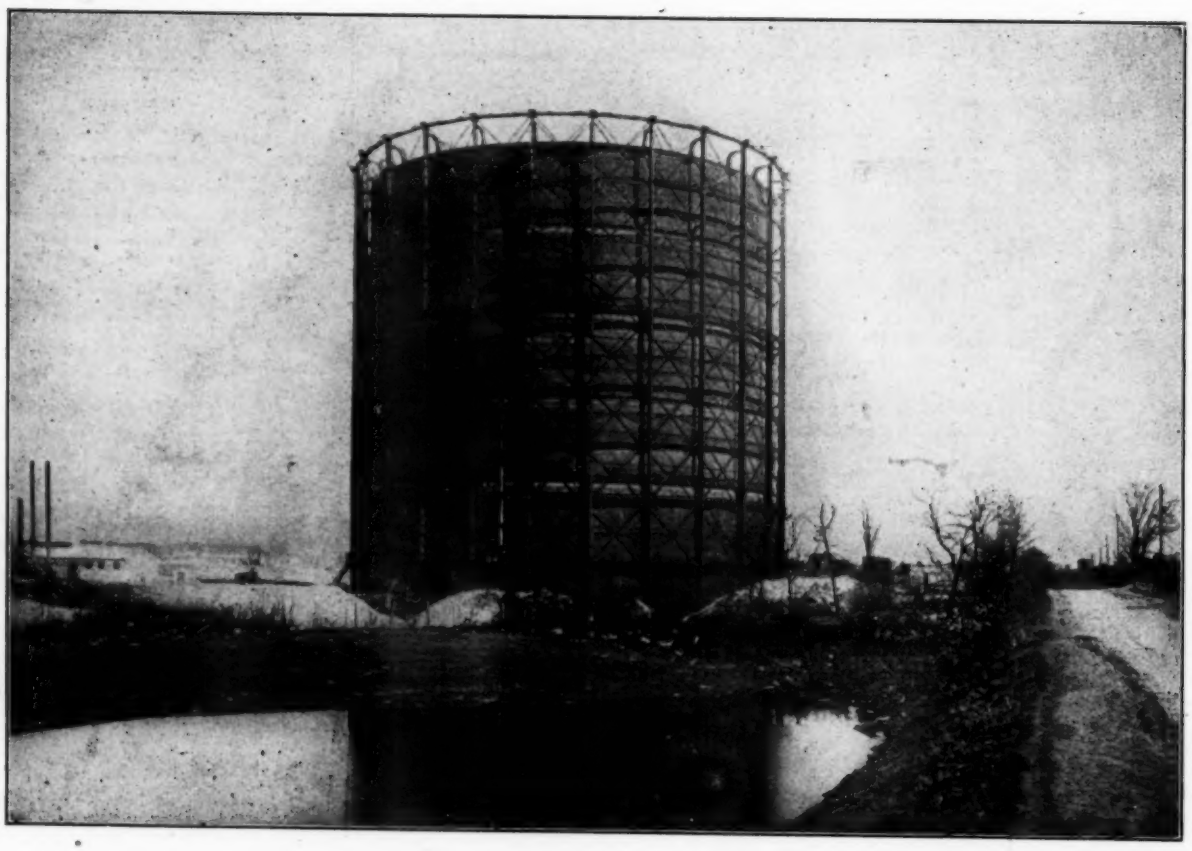

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OFFICE OF THE UNITED GAS IMPROVEMENT CO., N. W. CORNER BROAD AND ARCH STS., PHILADELPHIA, June 9, 1915.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable July 15, 1915, to stockholders of record at the close of business, June 30, 1915. Checks will be mailed.

2088-5 I. W. MORRIS, Treasurer.

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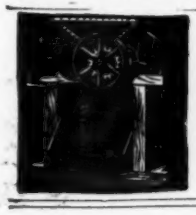

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Accounts, Uniform System of. Published by American Gas Institute. 128 pp. Flexible leather. $5 non-members, $2.50 members.

The system of accounts has been prepared in accordance with the latest thoughts on this subject, and follows closely the principle of accounting promulgated by the various public service commissions throughout the country. This system of accounts is most comprehensive in its scope, the explanations are very clear and the system is so elastic in its application as to make it thoroughly adaptable to the operations of both large and small companies. Embodied in the system is a report form, prepared in accordance with the classification of accounts. This report form, when filled out with the information called for, will enable managers and operators of gas companies to get a clear insight into the detailed operations of their properties, and to tell at a glance where there is a leak or unnecessary expenditure.

Calorific Power of Fuels. By Herman Poole. 255 pages. $3.

Calorimetry is fully and ably discussed in this book. The work decribes methods of determining the heat of combustion. The installation, evaluation and correction of calorimeters for readings is taken up. Calorimeters with a constant pressure and calorimeters with a constant volume, are discussed in two chapters and three chapters are devoted to solid, liquid and gaseous fuels. Tables of heats of combustion of fuels and the report of the committee on boiler tests of the A. S. M. E., with tables of constants used, is added.

Chemistry of Gas Manufacture. By H. M. Royle. $4.50.

This book covers points likely to arise in the ordinary course of the duties of the engineer or manager of a gas works not large enough to necessitate the employment of a separate chemical staff. It treats of the testing of the raw materials employed in the manufacture of illuminating coal gas, and of the gas produced. The preparation of standard solutions is given, as well as the chemical and physical examination of gas coal, including among its contents Preparations of Standard Solutions, Coal, Furnaces, Testing and Regulation. Products of Carbonization. Analysis of Crude Coal Gas. Analysis of Lime. Ammonia. Analysis of Oxide of Iron. Naphthalene. Analysis of Firebricks and Fireclay. Weldom and Spent Oxide. Photometry and Gas Testing. Carburetted Water Gas. Metropolis Gas. Miscellaneous Extracts. Useful Tables.

Coal Gas Residuals. By Frederick H. Wagner, M.E. $2.

The first book to describe in detail the European methods of utilizing coal gas residuals and to explain how they can be applied to American conditions—a work of vital importance to gas companies, chemical engineers, etc. The book is a complete discussion of the Feld theory and practice. It gives full details of standard methods and the latest developments. The author has made thorough investigations of his subject because of the lack of general information on this subject in America, and the consequent waste of natural resources. His work is especially timely. He treats all residuals except coke, which he plans to discuss later in a separate volume. CONTENTS: I.—Tar. II.—Naphthalene. III.—Cyanogen. IV.—Ammonia. V.—Benzol. VI.—Tests.

Coal Tar Distillation and Working Up of Tar Products. By Arthur R. Warnes. With illustrations. $2.50.

A text book for the managers of tar works, coke oven works, gas works, and students of technical chemistry. SYNOPSIS OF CHAPTERS: Coal Tar.—How Tar is Received from Gas Works.—Plant Used in Distillation of Coal Tar.—Plant for Recovering Cresylic and Carbolic Acids from Oil.—The Recovery of Carbolic and Cresylic Acids.—Plant for the Recovery of Benzols, Naphthas, etc.—The Recovery of Benzols and Naphthas.—First Distillation and Washing.—The Rectification of Benzols and Naphthas.—Plant for the Working Up of Pyridine from Pyridine Acid.—The Recovery and Rectification of Pyridine Bases.—Plant for the Manufacture of Crude Naphthalene and Anthracene.—The Manufacture of Crude Naphthalene and Anthracene.—Pitch and Pitch "Getting."—Creosote.—Tar Works Tests.—Appendix.

Manufacture of Sulphate of Ammonia. By Gascoigne T. Calvert. With about 100 illustrations. $3.

A book for the use of practical men. Contains full working details as to the manufacture of sulphate of ammonia. Designed to meet the requirements of large or small makers of sulphate. SYNOPSIS OF CHAPTERS: Sulphate of Ammonia, its Composition and Analysis.—The Raw Materials: Ammoniacal Liquor, Sulphuric Acid and Lime.—Plant required for the Manufacture of Sulphate of Ammonia: General Description, Supply of Ammoniacal Liquor, Tachometer, Superheaters, Stills, Liming Apparatus, Waste Liquor Valves, Cooling Arrangements, etc., Saturators, Drying, Storing, etc., the Waste Gases, etc.—Starting, Working and Stopping the Plant.—Alkali, etc.—Sulphate of Ammonia Manufacture for Small Gas Works.

Carbonization of Coal. By V. B. Lewes. 27 illustrations, 330 pages. $3.

A scientific review of the formation, composition and destructive distillation of coal for gas, coke and by-products. CONTENTS: The Formation, Composition, Classification and Distribution of Coal.—Form of Retorts used in Gas Manufacture.—Coke Ovens and their Development.—Conditions existing in the Destructive Distillation of Coal.—Primary Gaseous Products of the Destructive Distillation of Coal and the Bodies from which it has been formed.—Tar, its Formation, Use and Decomposition.—Coke.—Nitrogen and Sulphur of Coal and their Recovery.—Modern Coal Gas.—Appendix. The chemical and mechanical principles involved in the destructive distillation of coal are carefully pointed out and the work of various investigators critically presented, together with much data gathered from the author's own recent investigations, and he attempts to define the probable lines along which future advances in the carbonization of coal may be expected.

Handbook for Gas Engineers and Managers. By T. Newbigging. Eighth edition. 217 illustrations, 596 pp. $6.50.

CONTENTS: Coal.—Chief Kinds of Coal.—Storage of Coal.—Analyses of Coals and Cannels.—Spontaneous Ignition of Coal.—Gases Occluded in Coal.—Testing of Coal for its producing Qualities..—Specific Gravity of Coal.—Coal Distillation.—Gas Production.—Retort House.—Stack.—Retorts.—Heating of Retorts.—Inclined Retorts.—Machine Charging and Drawing.—Analysis of Furnace Gases.—Retort Bench Mountings.—Hydrocarbon and Other Gases and Vapors.—Retort House Tools and Appliances.—Condensation.—Naphthalene.—Condensers.—Exhausters.—Steam Engines and Boilers.—Washers.—Tower Scrubbers.—Washer-Scrubbers, etc.

Distribution of Gas. By W. Hole. Third edition. 687 illustrations, 865 pages. $7.50.

CONTENTS: Rights and Duties of Gas Undertakings.—Preliminary Considerations.—Discharges from Pipes under High Pressure.—Station Governors.—Cast Iron Pipes and Irregulars.—Steel Pipes and Connections.—Joints and Jointing.—Main Laying.—Valves and Main Cocks.—Subways.—Service.—Wet, Dry, Prepayment, and Fixing Meters.—Pipes and Joints for Internal Fitting.—Internal Fitting and Lighting—Gas Fires and Cookers.—Gas Engines.—Pressure Gauges and Registers.—Complaints and Repairs.—Gas as an Aid to Ventilation. Public Lighting: Low Pressure, Self-Intensifying and High Pressure Systems.—Lighting and Extinguishing Lamps.—High Pressure Distribution and Transmission.—Compressors.—High Pressure.—Distributing Apparatus.—Internal Lighting and Heating.—Unaccounted-for Gas.—Fusion and Electrolysis.—Appendix. A complete and comprehensive treatise, embodying all that is required as an outfit on the subject of distribution, not only to students, but also to managers of gas works. This new edition has been much enlarged and brought up to date by the addition of much new matter and the careful compression of the old material.

Handbook of American Gas Engineering Practice. By M. Nisbet Latta. Illustrated, 477 pages. $4.50.

CONTENTS: Water Gas Manufacture: Generator.—Carburetter.—Superheater.—Wash Box and Tar.—Scrubbers.—Condensers.—Purifiers.—Exhausters.—Station Meters.—Holders.—Works Operation. Gas Distribution: Naphthalene.—Mains.—Services.—Consumers' Meters.—Pressure.—House Piping.—Appliances.. General Technical Data: Properties of Gases.—Steam.—Mathematical Tables.—Conversion Factors.—Pipe and Miscellaneous Data.

Coal Tar and Ammonia. By George Lunge, Ph.D. 305 illustrations, 1,210 pages. Complete in two volumes. $15.

CONTENTS: Process of Obtaining Coal Tar.—Properties of Coal Tar and its Constituents.—Applications of Coal Tar without Distillation.—First Distillation of Coal Tar.—Pitch.—Anthracene Oil.—Creosote Oil.—Carbolic Acid and Naphthalene.—Light Oil and Crude Naphtha.—Working up the Light Naphtha into its Final Products.—Sources from which Ammonia is Obtained.—The Composition and Analysis of Ammoniacal Liquor and Properties of its Constituents.—The Working up of Ammoniacal Liquor.—Other Technically Important Ammonium Salts.—Appendix and Addenda.

Gas Piping and Gas Lighting, The American Practice of. By William Paul Gerhard, C.E. 310 pages. $3.

This book is written in a lucid and popular style, quite free from technicalities, and contains a large amount of well-digested and useful information. The author has avoided treating the various processes of manufacture and distribution, but takes up the subject of installation and gas utilization practically at the point where it reaches the consumers' premises. Besides that part of the text addressed particularly to the gas user, will be found many data and specifications of interest and value to the engineer, architect and builder.

Liquid and Gaseous Fuels and the Part they Play in Modern Power Production. By V. B. Lewes. Illustrated, 348 pp. $2.

CONTENTS: Combustion.—Formation and Composition of Fuel.—Determination of Calorific Value.—Liquid Fuels.—Use of Liquid Fuels.—Liquid and Gaseous Fuels.—Manufacture of Coal Gas.—Use of Coal Gas for Heating and Power.—Water Gas.—Poor Fuel Gas.—The Fuel of the Future.

Gas Engine Design. By C. E. Lucke. With figures and diagrams. Second edition. 145 illustrations, 262 pages. $3.

CONTENTS: Power.—Efficiency.—Forces in the Engine Due to Gas Pressure and Inertia.—Dimensions of the Engine Parts.

BOOKS FOR GAS MEN

Public Lighting by Gas and Electricity. By W. J. Dibdin. With tables, diagrams, engravings and full-page plates. 537 pp. $8.

CONTENTS: Artificial Light.—Photometers.—Illuminating Properties.—Physical and Chemical Properties of Coal Gas.—Jet Photometer.—Enrichment.—Gas Burners and Meters.—Incandescent Gas Lighting.—Self-Intensifying Gas Pressure.—Anti-Vibrators.—Lamp Governors.—Torch Lighting and Extinguishing.—Lighting Tables.—Heating Value of Coal Gas.—Generation of Dynamic Electricity.—Generators.—Motors.—Transformers.—Measurement of Current.—Distribution of Light.—Efficiency of Arc and Incandescent Lamps.—Comparison of Cost and Heating Effect of Lighting by Gas and Electricity.—Examples of Direct and Alternating Current Lighting Systems.—Acetylene.—American Experience.

Regulation, Valuation and Depreciation of Public Utilities. By Samuel S. Wyer. 313 pages. $5.

This book is not a brief for either the public or the public utilities, but is a discussion and compilation of pertinent, economic, engineering and legal facts relating to both sides. It is a discussion of basic principles, with digested opinions of experts and judicial decisions of our courts. It is an encyclopædia for the man that reads or writes on the subject of public utilities.

Gas Analyst's Manual. By Jacques Abady. 500 pages. $6.50.

CONTENTS: Chapters on Photometry.—Standards of Light.—Calorimetry and Specific Gravity.—Referee's Test for Sulphur and Ammonia.—Coal Testing.—Testing, Enrichment and Purification Materials.—Purity Tests for Gas in Various Stages of Manufacture.—Testing By-Products.—Technical Gas Analysis.—Meter and Governor Testing.—Tables and Data.

Modern Retort Settings, their Construction and Working. By T. Brooke. Illustrated, 200 pages. $3.

This work is an up-to-date account of retort settings as now used in modern gas works, and it is not difficult to see that the author writes of a subject in which he is both interested and experienced. Alterations in the construction of retort settings have been very necessary of recent years, owing to the increased heats worked. As a result it has become essential to use a great deal of care in building the settings and in protecting the retorts. With regenerative settings it is so easy to obtain excessive heats in the combustion chamber that it is imperative to thoroughly protect the retorts in this part of the setting. The author's views on construction are distinctly sound, and those who have not had much experience in this branch of gas works engineering will gain much information from perusal of the book. The author has spared no effort to place his material in a readily understandable form, in which he has been greatly aided by many excellent drawings. Special stress is laid upon recuperative settings and verticals are well described. The chapter on "Analysis of Producer and Waste Gases" is one of the most comprehensive included in the book.

Testing of Gas and Gas Meters. By C. H. Stone. 322 pages, 50 illustrations. $3.25.

The aim of this book has been to explain clearly simply and fully such tests as would be of practical service to the gas manager, chemist or photometrist, and to make such comments and suggestions as might guide him in his choice of apparatus or process and assist him to secure accurate and useful results therewith. For this reason all chemical processes, reactions and calculations have been explained at length. Divided into four parts: Photometry, Chemical Tests, Calorimetry, Specific Gravity and Pressure-Testing of Meters.

Modern Illuminants and Illuminating Engineering. By Leon Gaster and J. S. Dow, London, England. 462 pages, 204 illus-illustrations. $5.

The authors have treated the subject in broad general lines. The initial portion of the book is devoted mainly to the various illuminants, the central portion to photometry and the effect of light on the eye, and the last part to practical lighting problems. The authors have brought together a vast amount of matter not usually available in a single volume, and treated the subject somewhat different from that adopted in previous text. In your field of public and private lighting a degree of expert knowledge is called for nowadays such as was not thought of even a few years ago. Illuminating is now classed with the engineering professions, and an understanding of its principles is demanded on the part of the chief of every electric lighting and gas company. This book contains exactly the information you will find most useful in your special field. It is up to date in every particular, being written by two of the leading expert authorities on illumination. So many advances have been made in the last few years in the systems of lighting factories, schools, theatres, houses, streets, etc., that only the expert has been able to keep abreast of them. New methods have been devised for measuring illumination, for testing fixtures and determining the best type for any purpose, the calculation of illuminating efficiency, the best spacing and arrangement of lights, etc. Lighting companies are expected to be posted on all these subjects. This book gives you the results of expert knowledge in the best and most available form. Every topic of illuminating engineering is fully covered in simple and non-technical style.

Industrial Chemistry. A manual for the student and manufacturer by forty eminent specialists. Edited by Allen Rogers, in charge of Industrial Chemistry, Pratt Institute, Brooklyn, N.Y. 1,025 pages. $5.

"This book is well printed, well bound and shows the results of careful proof-reading. To get out such a work is a great undertaking and the editor is to be congratulated on the degree of success he has attained. Technical libraries, chemists, engineers and teachers will find this volume a necessary addition to their works on industrial chemistry."—PROF. M. C. WHITAKER, reviewing the first edition in the Journal of Industrial and Engineering Chemistry, November, 1912.

Public Utilities, their Fair Present Value and Return. By Hammond V. Hayes, Ph.D. 213 pages. $2.

A discussion of the line of reasoning which must be followed whose duty it is to ascertain the fair present value of a property after an appraisal has been made and all the necessary information relative to it has been obtained. Likewise the subjects of going value and depreciation have been treated at some length with the hope of removing some of the existing misunderstandings concerning them. The present work advocates the use of a method of valuation somewhat different from those that have been pursued in the past in that the use of overhead charges has been reduced to a minimum. It is believed that this method of caring for the costs usually claimed as overhead charges will tend to greater accuracy and will eliminate much future controversy. The discussion is confined entirely to public utilities subject to regulation by state or governmental authorities. CONTENTS: The Present Controversy.—Ascertainment of Fair Present Value.—Basis for Fair Charges for Service for New Company.—Basis for Fair Charges for Service for a Previously Unregulated Company.—Non-Competitive Successful Undertakings.—Non-Competitive Unsuccessful Undertakings.—Fair Value of Property of Competitive Undertakings.—Fair Rate of Return.—Replacement Cost.—Cost of Promotion; Physical Property; Going Value.—Actual Original Cost.—Going Value.—Depreciation.

Text Book of Gas Manufacture. By John Hornby. 408 pp. $3.

The book is intended for young men just starting their career in a gas works, and for students preparing for the examination in gas engineering. The object which has been kept in view has been to describe the general features of modern gas manufacture, and to explain the points to which special attention must be paid, in order to obtain economical results in working. It is not intended to be an exhaustive treatise on the subject, the student will be able to fill in details from his own experience on the particular works he may be connected with; at the same time it supplies a groundwork which should save him considerable labor in obtaining his preliminary knowledge.

Brown's Directory of American Gas Companies. 800 pp. $5.

This book is revised annually and contains a list of gas companies in the United States, Canada and Mexico selling both Artificial and Natural Gas, a list of Public Service Commissions, and a list of members of all the Associations, arranged alphabetically. This book should be in the hands of every gas man and those doing business with gas companies.

Gas Engineers' Pocket-Book. By H. O'Connor. Full leather. 478 pages. $3.50.

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MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

AMERICAN GAS INSTITUTE.—Annual meeting, San Francisco, Cal., week of Sept. 27, 1915. Officers: President, E. C. Jones, San Francisco, Cal.; Secretary, Geo. G. Ramsdell, 29 West 39th St., N. Y. City.

CANADIAN GAS ASSOCIATION.—Annual meeting, Montreal, Sept. 16 and 17, 1915. Officers: President, H. E. Mann, Montreal; Secretary and Treasurer, John Keillor, Hamilton, Ont.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION.—Annual meeting, New York City, Oct., 1915. Officers: President, J. C. De Long, Syracuse, N. Y.; Secretary, C. H. B. Chapin, 29 West 39th Street, New York City.

GAS METERS.—Monthly Section Meetings: Grand Commissioner, F. H. Hutchinson, care East Ohio Gas Co., Cleveland, O.; Gen'l Sec'y, J. M. Brock, 538 Dean Street, Brooklyn, N. Y.

New York Section—Chairman, C. E. Chapple; Secretary, A. M. Berg, 1493 Broadway, New York City.

Cleveland Section—Chairman, J. G. Hanks; Secretary, W. G. Barker, 1447 E. 6th Street, Cleveland, O.

Philadelphia Section—Chairman, E. G. Bartlett; Secretary, R. H. Predmore, 1401 Arch Street.

New England Section—Chairman, E. B. Mooney; Secretary, A. F. Pettingill, Cambridge, Mass.

GUILD OF GAS MANAGERS OF NEW ENGLAND.—Annual meeting, March, 1916. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, J. A. Gould, Boston; Vice-President, N. W. Gifford, East Boston; Treasurer, W. F. Norton, Nashua, N. H.; Secretary, H. K. Morrison, Lynn.

ILLINOIS GAS ASSOCIATION.—Annual meeting, March 22, 23, 1916. Chicago, Ill. Officers: President, R. B. Harper, Chicago, Ill.; Secretary-Treasurer, Horace H. Clark, 72 W. Adams Street, Chicago, Ill. Room 1325.

ILLUMINATING ENGINEERING SOCIETY.—Annual meeting, Washington, D. C., September, 1916. President, Dr. C. P. Steinmetz; General Secretary, A. S. Miller, 165 Broadway, New York.

Chicago Section—Chairman, E. W. Lloyd; Secretary, O. L. Johnson.

New York Section—Chairman, D. McFarlan Moore; Secretary, N. D. Macdonald.

New England Section—Chairman, Louis Bell; Secretary, S. C. Rogers.

Pittsburg Section—Chairman, L. J. Kiefer; Secretary, R. H. Skinner.

Philadelphia Section—Chairman, G. S. Crampton; Secretary, L. B. Eichengreen.

INDIANA GAS ASSOCIATION.—Annual meeting, March, 1916. Indianapolis. Officers: President, J. H. Maxon, Muncie; Secretary-Treasurer, J. W. Dunbar, New Albany.

IOWA DISTRICT GAS ASSOCIATION.—Annual meeting, May, 1916. Officers: President, A. L. English, Council Bluffs, Ia.; Secretary, T. B. Genay, Des Moines, Ia.

MICHIGAN GAS ASSOCIATION.—Annual meeting, Detroit, September 23 and 24, 1915. Officers: President, J. T. Young, Grand Rapids, Mich.; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

MONTANA GAS ASSOCIATION.—Annual Meeting, Helena, Mont., November, 1915. President, G. A. Strain, Helena, Mont.; Secretary, I. C. Covert, Billings, Mont.

NATIONAL COMMERCIAL GAS ASSOCIATION.—Annual meeting, Dec., 1915, Washington, D. C. Officers: President, H. B. McLean, New York, N. Y.; Secretary, Louis Stotz, 61 Broadway, New York City.

NATURAL GAS ASSOCIATION.—Annual meeting, Pittsburgh, Pa., May, 1916. Officers: President, W. Y. Cartwright, Cincinnati, O.; Secy-Treas., T. Clive Jones, Delaware, O.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.—Annual meeting, Boston, Mass., February, 1916. Officers: President, H. K. Morrison, Lynn, Mass.; Secretary, N. W. Gifford, East Boston, Mass.

NEW JERSEY STATE GAS ASSOCIATION.—Next meeting, July, 1915. President, S. J. Franklin, Millville, N. J.; Secy-Treas., O. F. Potter, Newark, N. J.

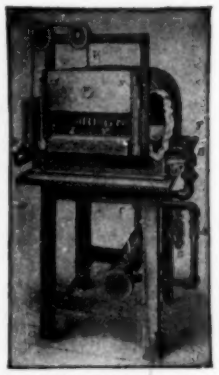
PACIFIC COAST GAS ASSOCIATION.—Annual meeting, San Francisco, Cal., September, 1915. Officers: President, E. C. Jones, San Francisco, Cal.; Secretary-Treasurer, Henry Bostwick, 445 Sutter Street, San Francisco, Cal.

PENNSYLVANIA GAS ASSOCIATION.—Annual meeting, Easton, Pa., April, 1916. Officers: President, B. F. Cresson, Easton, Pa.; Secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

SOCIETY OF GAS LIGHTING.—Annual meeting, December, 1915; monthly meetings, second Thursday. Place, New York City. Officers; President, Fred S. Benson; Secretary, George G. Ramsdell, 29 West 39th Street, New York City.

SOUTHERN GAS ASSOCIATION.—Annual meeting, Tampa, Fla., Apr. 19, 20, 21, 1916. Officers: President, McD. Dexter, Charleston, S. C.; Secretary-Treasurer, E D. Brewer, 45 Poplar Circle, Atlanta, Ga.

WISCONSIN GAS ASSOCIATION.—Annual meeting, 1916. Officers: President, W. C. Butterworth, Platteville, Wis.; Secretary-Treasurer, Henry Harman, Milwaukee, Wis.



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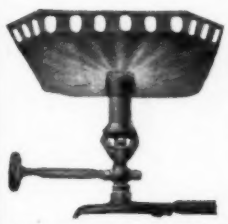


INSURES PERFECT COMBUSTION, because the Direct Acting Gas Cock with which it is fitted, controls the flow of gas by increasing or decreasing the size of the orifice, thereby maintaining the full velocity of the jet, whether the gas is burning full, or only part on.

THE FLAME IS ALWAYS CLOSE UP TO THE WORK, whether turned high or low, for the burner head is placed directly up against the bottom of the thing being heated, as shown in the illustration.

LITTLE HEAT IS LOST through radiation into the atmosphere, because the products of combustion, after they leave the flame zone, are in direct contact with the vessel, instead of having to pass through space to reach it, as is the case when the burner is not close up to the work.

It's worth investigating. Order a sample.

The Johnson Gas Appliance Co.
524 E Ave. West, Cedar Rapids, Iowa

KNOWLEDGE

The pamphlets issued by manufacturers advertising in The American Gas Light Journal contain valuable data.

Write for them---read them.

Mechanical Engineers' Pocket Book

BY WILLIAM KENT. 1,461 PAGES. $5.

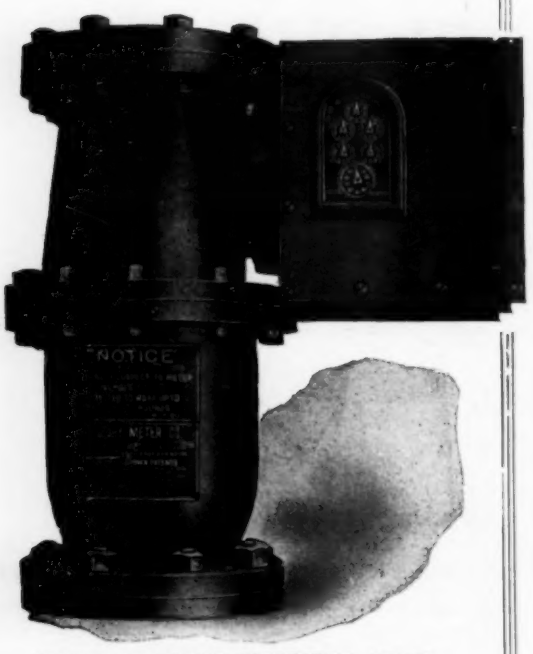
A reference book of rules, tables, data and formulæ, for the use of engineers, mechanics and students. Following are subjects:

Mathematics—Materials—Strength of Materials, including Alloys—Ropes, Chains, Springs, Riveted Joints—Iron and Steel—Mechanics—Heat, Thermodynamics—Physics of Gases—Air, including Fans, Compressed Air, etc.—Heating and Ventilation—Water, including Wheels, Pumps. etc.—Fuel, including Illuminating Gas—Steam and Steam Pipes—Boilers and Chimneys—Steam Engines, including Turbines—Internal Combustion Engines—Locomotives—Shafting. Pulleys, Belting, Gearing—Hoisting and Conveying, including Transmission of Power by Wire and Manila Ropes—Friction and Lubrication—The Foundry—The Machine Shop—Dynamometers—Ice Making or Refrigeration—Marine Engineering—Construction of Buildings—Electrical Engineering.

For Sale by AMERICAN GAS LIGHT JOURNAL, 42 Pine St., New York City

THE ROTARY PRESSURE-CORRECTING METER

FOR HIGH-PRESSURE GAS



ROTARY PRESSURE CORRECTING METER
STYLE "D"

A Measurer irrespective of variations in pressure and a record on a free gas basis

Under actual working conditions, installations of this meter in *high pressure plants* have demonstrated its practicability and its dependability as a thoroughly accurate and reliable machine to meet the demands for a meter whose dial would correctly record the volume of gas passing on a *free gas* (atmospheric) basis, irrespective of the fluctuations in pressure.

This is the first and only meter of the kind that is absolutely positive and dependable, the records of which are

AUTOMATIC CONTINUOUS ACCURATE

The meter is a combination of the Rotary Meter, and the multiplying, integrating and recording mechanism.

Thousands of Standard Rotary Meters embodying this construction have been in use for years under all conditions without trouble from wear or impairment of accuracy.

Those who have installed them are our references.

Correspondence invited.

Booklet Sent upon Request

ROTARY METER COMPANY

280 BROADWAY, NEW YORK

E. C. BROWN, President

ROTARY METER COMPANY
TRADE MARK

INDUSTRIAL GAS APPLIANCES

Sell themselves after a trial demonstration.

Advertisements in the AMERICAN GAS LIGHT JOURNAL also sell themselves after a demonstration.

Try it and be convinced.

CALKING

is done best when the material is hammered home evenly and surely.

Advertising in the AMERICAN GAS LIGHT JOURNAL will hammer home your story to the buyer.

GENERATORS

bring carbon and oxygen together. Advertisements in the AMERICAN GAS LIGHT JOURNAL bring buyer and seller together.

PURIFYING

makes gas salable. Advertising in the AMERICAN GAS LIGHT JOURNAL will help make your product salable.

WINDOW DISPLAYS

are important factors in retail merchandizing.

An advertisement in the AMERICAN GAS LIGHT JOURNAL, printed 52 times a year and dressed as often, will make an effective window display for the Manufacturer.

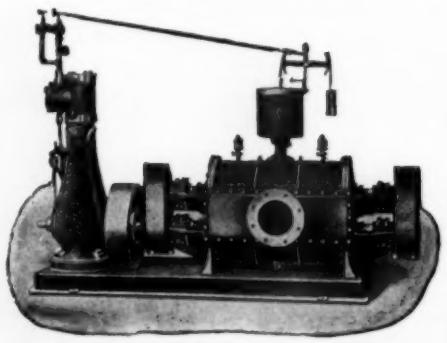
Our service department is at your command to assist you in making your display

ATTRACTIVE

NOTE: This advertisement occupies 1/2 of a page. The 1/4, 1/8 and 1/16 sized spaces are shown opposite.

Send cuts and copy to fit these spaces.

VISIT OUR EXHIBIT AT THE EXPOSITION



ROOTS EXHAUSTERS For Foul Gas Pumping
ROOTS BLOWERS For Industrial Appliances

BOOTH 38, COLLECTIVE GAS EXHIBIT, PALACE OF MANUFACTURERS,
PANAMA-PACIFIC INTERNATIONAL EXPOSITION

P. H. & F. M. ROOTS COMPANY

CONNERSVILLE, INDIANA

NEW YORK, 120 Liberty Street CHICAGO, 1245 Marquette Building

BLOWERS

CONNERSVILLE

GAS PUMPS

BUILT UP TO A HIGH STANDARD
AND NOT DOWN TO A LOW PRICE

THE CONNERSVILLE BLOWER CO.
CONNERSVILLE, IND.
CHICAGO. NEW YORK.

INTERNATIONAL GAS CONGRESS

AND

TENTH ANNUAL MEETING

AMERICAN GAS INSTITUTE

SAN FRANCISCO, CALIFORNIA

September 27th - October 2nd

1915

GAS BENCHES

Complete Coal Gas Plants
WATER GAS LININGS

D. R. RUSSELL ENGINEERING AND DEVELOPMENT CO.
DESIGNING AND CONSTRUCTING ENGINEERS
OFFICE 519-523 INTERNATIONAL LIFE BUILDING, SAINT LOUIS

Ample Cheerful Dependable Light at Low Cost and No Glare!

Store fronts need plenty of light, just such light as is produced by Pennsylvania Globe High Pressure Gas Lamps.

These lamps give a very strong, but at the same time cheerful, well-diffused light — without glare. It little matters just why it is so, but it is recognized as a fact that, while most people like plenty of light, glare is "too much." Oftentimes it has the effect of cheapening a place, and it always has a tendency toward straining the eye and making it hard for people to see what is in the window, and decidedly uncomfortable to remain.

Lay these facts before the storekeepers of your town and they will realize the advantages of installing Pennsylvania Globe High Pressure Gas Lamps for increasing and holding business.

AMPLE LIGHT — CHEERFUL LIGHT — DEPENDABLE LIGHT

And at Low Cost

AND NO GLARE!

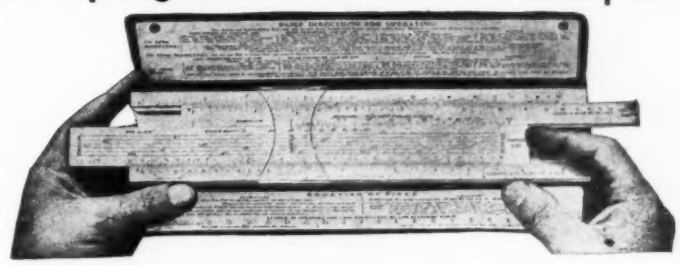
THE PENNSYLVANIA GLOBE GAS LIGHT COMPANY,

Manufacturers of High Pressure Gas Lamps,

1934 MARKET STREET, PHILADELPHIA, PA.

No 212

The Spitzglass Slide Rule and Computer.



Automatic Solution of all problems dealing with the flow in pipes of

STEAM, WATER, LOW PRESSURE AIR, NATURAL GAS, COKE OVEN GAS, COMPRESSED AIR, ILLUMINATING GAS, AMMONIA GAS, PRODUCER GAS, etc.

ELIMINATES CHARTS, TABLES AND LABORIOUS COMPUTATIONS.

Three Features Combined.

1. Solves quickly and simply all problems involving the flow of fluids in pipes.
2. The results are more accurate than those obtained by other formulas, because the rule is based on new experimental data.
3. Accomplishes all ordinary slide rule calculations.

Made of solid seasoned white celluloid, fastened to durable leather folding case, convenient for the pocket.

Net Price, with Manual, Postpaid, $10.

For Sale by the

AMERICAN GAS LIGHT JOURNAL, 42 Pine St., New York City.

4000 users of BROWN PYRO-METERS

Have told us how they save them money. The information is yours for the asking.

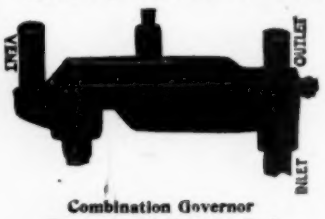
The Brown Instrument Co.

Philadelphia, Pa.

New York Pittsburgh Chicago

REYNOLDS GOVERNORS

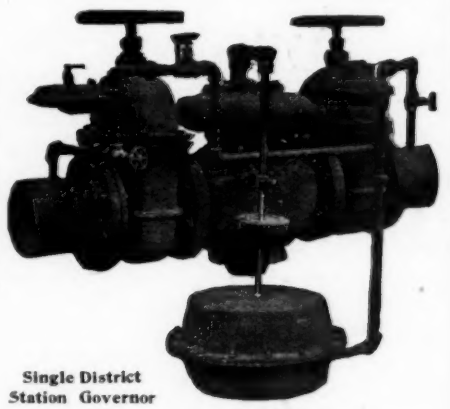
We make anything desired in the GAS GOVERNOR or REGULATOR to meet any and all classes of reductions. Stations for DISTRICT SERVICE, INDIVIDUAL HIGH PRESSURE GOVERNORS for reducing high pressure gas to inches of water. Holder and Low Pressure Service Governors. A steady, uniform pressure can be obtained by using REYNOLDS GOVERNORS, "THE WORLD'S STANDARD." We make a specialty of the Governor business, devoting our entire time to the manufacture of same. All Governors are GUARANTEED.



Combination Governor
Governor and Mercury Seal

REYNOLD'S GAS REGULATOR COMPANY
ANDERSON, INDIANA. U. S. A.

Write for instructive Catalog


Single District
Station Governor

THE FULTON GAS PRESSURE GOVERNORS

FOR ARTIFICIAL OR NATURAL GAS

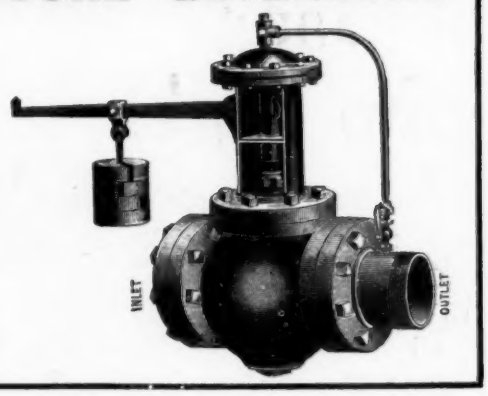
Have you seen our Improved Duplex Sensitive Gas Governor, for district service? You ought to investigate it. Reduces high pressure gas to inches of water without variation. No auxiliary governors or dashpots required.

The most simple and perfect governor ever placed on the market.

See also our Reducing Governor for compressed gas. Takes any inlet pressure in pounds, and reduces to any desired outlet pressure in pounds.

More than 25 years' experience with the largest gas companies. Send for catalogue.

THE CHAPLIN-FULTON MFG. CO. { PITTSBURGH PA.



HELME & McILHENNY,

1339 to 1349 Cherry St., Philadelphia, Pa.

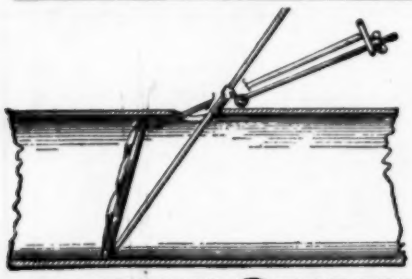
ESTAB. 1848 H & McI

GAS METERS.

HINMAN DRUM STATION METERS, FOULIS GAS GOVERNORS, PREPAYMENT METERS.

REPAIRING AND CONVERTING.

PROMPT SHIPMENTS. - - - - CORRESPONDENCE SOLICITED.



GOODMAN STOPPER
The Half Minute
GAS MAIN SHUT-OFF

Manufactured and Sold by Safety Gas Main Stopper Co. 257-263 E. 133d St., New York.

AGENTS.

Pacific Coast—VAN E. PRATTON, 269 Monadnock Building, San Francisco, Cal.

Great Britain—PARKER & LESTER, Ormside Street, Old Kent Road, London, S. E.

See us at Booth 24, Collective Gas Exhibit Panama-Pacific International Exposition, San Francisco, Cal.

GEORGE ORMROD, Pres. & Treas. JOHN D. ORMROD, Vice-Pres. & Supt. J. G. EBERLEIN, Secretary.

EMAUS PIPE FOUNDRY — CAST IRON GAS & WATER PIPE — DONALDSON IRON CO. EMAUS, PA.

Manufacturers of CAST IRON PIPE AND SPECIAL CASTINGS FOR WATER AND GAS, also FLANGE PIPE and FITTINGS for same.

COX'S LOW PRESSURE COMPUTER, Price, $2.50
COX'S HIGH PRESSURE COMPUTER, " 5.00

For Sale by AMERICAN GAS LIGHT JOURNAL
42 Pine St., New York City

THE MARYLAND METER

Original Manufacturers of

"B" METERS

for Increased Capacity under slow speed Operation

ARTIFICIAL AND NATURAL GAS METERS
PREPAYMENT METERS, STATION METERS
METER PROVERS, COMPLAINT METERS, &c.
SPECIAL ATTENTION TO REPAIR WORK

CHARLES H. DICKEY & CO.

BALTIMORE — CHICAGO

N. W. REPRESENTATIVE-NORTHWEST GAS EQUIPMENT CO., 1010 SPALDING BUILDING, PORTLAND, ORE.

NATHANIEL TUFTS METER COMPANY,

455 COMMERCIAL STREET, BOSTON.

Established 1860.

MANUFACTURERS OF

GAS METERS.

POSITIVE PREPAYMENT GAS METERS, THE HINMAN STATION METER DRUM, EXPERIMENTAL APPARATUS.

A thorough and complete department for METER REPAIRING of All Descriptions.

IMPROVED METERS

We Build, Repair and Convert Meters

Our Prepayment Attachment can be attached in your meter shop

Send for Sample

NEW YORK IMPROVED METER CO.
306-310 East 47th Street
NEW YORK CITY

DIXON'S

SILICA GRAPHITE PAINT

More than fifty years of practical service have made this the standard protective paint for all metal surfaces exposed to weather. Send for Paint Booklet No. 231.

Made in JERSEY CITY, N, J., by the

Joseph Dixon Crucible Co.

Established 1827.

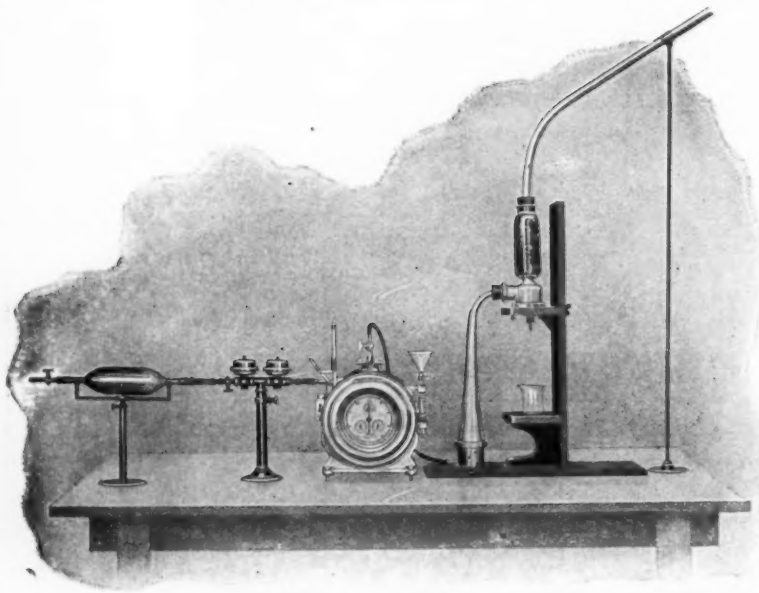
Handbook for Gas Engineers and Managers

By THOMAS NEWBIGGING

Price, $6.50. For Sale by

AMERICAN GAS LIGHT JOURNAL
42 Pine Street, New York City

NEW YORK. PHILADELPHIA. CHICAGO.



THE AMERICAN METER COMPANY
ESTABLISHED 1836.

REFEREES SULPHUR AND AMMONIA TEST.

We are now manufacturing this apparatus in its most up-to-date form.

CATALOGUE SENT ON REQUEST.

THE AMERICAN METER COMPANY

11TH AVE. AND 47TH ST., NEW YORK CITY.

We would invite your attention to our exhibit in the Collective Gas Exhibit at the Panama-Pacific International Exposition, which has been awarded the Grand Prize; also to the exhibit of our apparatus made by the U. S. Bureau of Standards in the Government Building.

Save 65% of the money you spend for meter maintenance by installing Sprague Meters

SPRAGUE METER CO.
Bridgeport, Conn.

Los Angeles, Cal. Davenport, Iowa. San Francisco, Cal.

SEE OUR EXHIBIT AT THE PANAMA-PACIFIC EXPOSITION.

METERS and REGULATORS
for NATURAL and ARTIFICIAL GAS

Sizes 3-4 inch to 24 inches

Catalogue on Application

EQUITABLE METER COMPANY

422-434-436 First Avenue Pittsburgh, Pa.

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PAGE 14

ESTABLISHED 1855.

McDONALD METERS

NOTED FOR ACCURACY.

CONSUMERS' METERS, REGULAR AND PREPAYMENT.
STATION METER WORK OF EVERY DESCRIPTION.
METERS REPAIRED. METER PROVERS.
CORRESPONDENCE SOLICITED.

D. McDONALD & CO.,

NEW YORK. ALBANY, N. Y. CHICAGO.

A Day To Celebrate

is the day you determine to standardize your meter system by using only---

IRONCLAD

THE 100% METER

You will remember the day as the one after which your meter troubles ceased.

The dependable "Ironclad" will measure your gas accurately for years with little attention.

"Ironclad" maintenance is lowest—none excepted.

Pittsburgh Meter Company

General Office and Works: East Pittsburgh, Pa.

NEW YORK,	CHICAGO,	KANSAS CITY,
149 Broadway.	337 W. Madison St.	6 West 10th St.
COLUMBIA, S. C.,	SEATTLE,	LOS ANGELES,
1230 Washington St.	802 Madison St	63 South Spring st.

Also Manufacturers of Keystone and Eureka Water Meters, Positive and Proportional Gas Meters for Any Pressure, and Meter Provers.

ACCURACY

"We have built our reputation around that word."

Mr. Gas Man:--When you consider the question of

METERS

The thing you should think of is

Accuracy.

Send for Catalogue on "A" Meters

KEYSTONE

Meter Company, Royersford, Pa.

Repairing a Specialty

JOHN J. GRIFFIN & CO.,

1513 TO 1521 RACE STREET,
PHILADELPHIA.

559 West 47th Street,
NEW YORK.

GAS METERS,

Station Meters and Apparatus of Every Description.

REPAIRING CAREFULLY DONE.

THE POSITIVE PREPAYMENT METER.

MORE THAN
ONE MILLION ARE IN USE
IN THE UNITED STATES AND THE DEMAND IS STEADILY INCREASING.

If you have some ordinary meters to be repaired, send them to us and let us repair and convert them into prepayment meters. They will be a source of satisfaction and profit to you.

SEND FOR OUR CATALOGUE AND OUR PREPAYMENT BOOKLET.

LBMr'16